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STUDIES IN BONE HEALING

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THE destruction of large portions of the maxillary bones has presented a major problem in oral surgery, a problem that becomes increasingly important because of war casualties. A method that would make the repair of these conditions more rapid and more certain would be of particular value at this time.

Of the many studies in bone healing that are recorded in medical literature, those most pertinent to this study have been reported by MacEwen[1] and Murray.[2] From a consideration of the studies made by Bancroft,[3] Robison[4] and others, Murray concluded that, among many important conditions, the availability of mineral salts at the site of healing was important in bone repair.

Murray removed 2 cm. of bone and periosteum from the radius of a series of dogs. He reported that if the section was not replaced or if it was decalcified and replaced, fibrous union always resulted. He further reported that if the section of bone was replaced, bony union followed; and that this occurred even if the bone was boiled or comminuted. Murray continued his experiments by filling the gap in the radius with calcium carbonate and calcium phosphate, and with calcium hexosephosphate. In these experiments, he reported that bony union was obtained. Shands[5] repeated Murray's experiments, using glycerophosphate as a chemical stimulant to bone repair. He reported that he was successful in obtaining bony

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union. Stewart,[6] in a series of similar experiments, reported that he was unable to establish a bony union.

Work done by MacEwen in 1912 suggests that the exclusion of differentiated connective tissue in the healing process is, perhaps, an important factor in the promotion of bone repair. In speaking of damaged periosteum in a case of osteomyelitis, he says, "Even in such a case, the periosteum acts as a barrier between the soft tissue and the embryonic bone cells."[7] He also reports an experiment in which he removed $1\frac{1}{8}$ inches of a dog radius and fitted a glass tube to one of the cut ends of bone. Part of the tube was filled with new bone in eight weeks' time.[8]

It is known that bone, a derivative of connective tissue, must revert to its primitive state, that of differentiated tissue, in order that its repair may be effected. In the light of MacEwen's and Murray's work, it seems that a

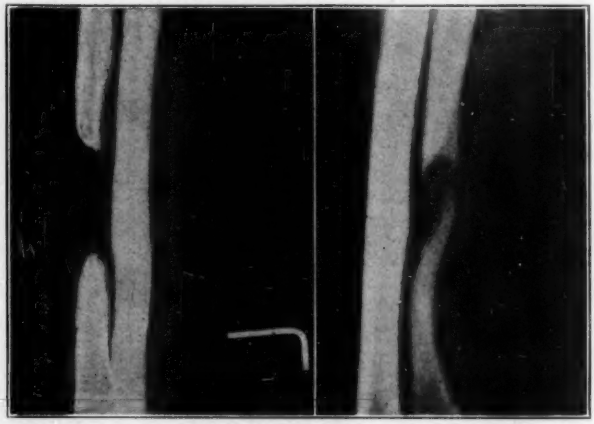

Fig. 1.—Left: Control case, eight weeks after operation. There is no evidence of repair in the region of excision of the section of bone. Right: Similar operation, with addition of use of bone paste, without protection by tantalum foil. Failure of new bone to bridge the gap is evident.

bone graft, when placed, tends to exclude differentiated tissue from the area, furnish the necessary mineral salts and, in a medium favorable to calcification through an altered pH brought about by a change in circulation, effect repair.

It seemed that if the salts of bone could be deposited in a matrix of suitable character, the resulting substance might be effective in initiating bone repair. Chemical salts, in the proportion found in bone, were incorporated in a gelatine base forming a putty-like mass. This mass was forced into a glass tube fitted with a glass rod of suitable size, which acted as a plunger. The material could be autoclaved and extruded as needed for the

experiments. It was hoped that this material, in addition to furnishing the necessary mineral salts to promote bone repair, would be effective in excluding differentiated connective tissue from the area while healing was taking place.

Two centimeters of bone and periosteum was removed from the radius of a series of dogs and it was found that, as in previous experiments, fibrous union always resulted. Figure 1, left is a roentgenogram showing the bone in a control case eight weeks after the operation. There is no evidence that bone has filled the breach.

A similar experiment was performed with the exception that synthetic bone paste was placed in the breach. Roentgenographically, the mineral salts appeared to be withdrawn from the area within ten days following the operation. Figure 1, right shows the gap nearly closed with new bone at the end of eight weeks. Failure of the new bone to completely bridge the

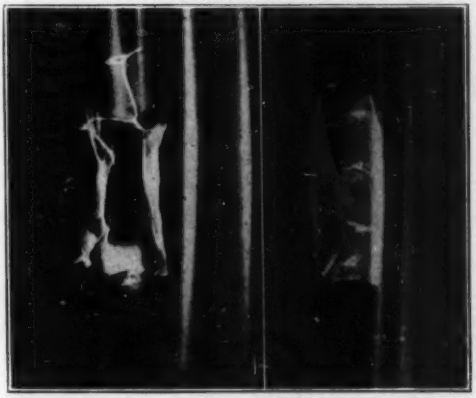

Fig. 2.—Left: Use of tantalum with failure to protect bone paste between fragments against absorption by surrounding tissues. Right: Results of use of thicker tantalum foil (more effective protection of bone paste).

gap was believed to be due to the interference of the surrounding differentiated connective tissue, and perhaps to the too rapid withdrawal of the synthetic bone paste from the area. In order to restrict the movement of differentiated connective tissue into the healing area, and in an effort to control the movement of the mineral salts, tantalum foil was used. This metal seems to be unusually non-irritating to the tissues.

Two centimeters of a dog radius was removed and the gap protected by a tube made from tantalum foil 0.0005 cm. in thickness. Figure 2, left shows the foil in place. In one case, the tube was filled with synthetic bone paste; in another, the bone paste was omitted.

Figure 2, right shows a later operation, in which thicker tantalum foil

was used. It is apparent that we were able to place the thicker foil in a much more satisfactory manner.

Figure 3, left shows the healing that had taken place twenty-eight days after an operative procedure in which tantalum foil and bone paste were used. The tantalum foil was removed five days later, as is shown in Figure 3, center. Figure 3, right shows the healing that had taken place in this case ten weeks after the operation.

Figure 4 shows the healing that had taken place five weeks after an operation in which the tantalum foil was used but the bone paste was omitted. The tantalum foil has been removed and no bony union is apparent.

In two cases in which tantalum foil and bone paste were used, bony union had not been obtained five weeks after the operative procedure. It was believed that this might be due to excessive mobility of the ends of the bone. At the present time, tantalum splints are being used to eliminate this possibility.

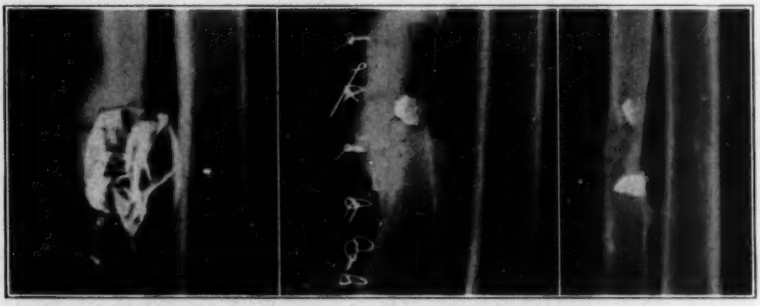

Fig. 3.—Left: Effects of use of heavy tantalum foil around bone paste between fragments (twenty-eight days after operation). Center: Condition thirty-three days after operation. The tantalum foil has been removed and bony union is progressing. Right: Result 103 days after operation. There is complete bony union.

From the foregoing experiments, it seems probable that before bony union can be effected, it is necessary to exclude the surrounding soft tissue from the area of bone repair, and, further, that, for bony union, it is necessary for the area to contain an adequate supply of mineral ions. There is also some indication that rigid fixation of the bone ends tends to make a bony repair more certain.

Synthetic bone paste has been used with very satisfactory results to fill crypts as large as 3 cm. in diameter, resulting from the enucleation of radicular cysts from the maxillary bones of patients. This and the foregoing findings suggest that the synthetic bone paste and tantalum, used either separately or in conjunction, may have important clinical applications.

An important if not the only function of periosteum is that of acting as a delimiting membrane in the process of bone growth. Since tantalum foil causes little or no irritation in tissue, it seems to be a satisfactory substitute for periosteum in this respect. Heavier pieces of tantalum might be used to effect rigidity as an aid to bone repair. If it were used in this way, its non-irritating character should be of advantage.

The use of synthetic bone paste in crypts in the maxillary bones seems to eliminate the dead space, furnish mineral salts and keep the periosteum distended until the organic matrix has been formed for bone repair. This tends to eliminate the depression that is very likely to overlie the healed area of an enculeated cyst.

Synthetic bone paste, or a combination of this material and tantalum foil, might be used to advantage in the treatment of non-union in fracture

Fig. 4.—Control case: Failure of bony union five weeks after operation. Tantalum foil was used, but no bone paste.

cases. This should be particularly applicable when, after injury, the connective tissue bed is thin.

It seems that a combination of molded tantalum splints and synthetic bone paste might be useful in promoting repair in those cases in which large areas of bone have been destroyed.

SUMMARY

When 2 cm. of a dog radius with its periosteum was resected, fibrous union always resulted. When the synthetic bone paste alone was used to fill the breach, there was partial, but not complete bony regeneration. When the movement of the synthetic bone paste and of the surrounding soft tissue was restricted by the use of tantalum foil, complete bony union was

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obtained. When tantalum foil alone was used, no bony union was obtained. The failures resulting in some of the cases in which tantalum foil and synthetic bone paste were used suggest splinting of the bone ends in conjunction with the use of synthetic bone paste and tantalum foil, in order to secure rigidity.

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The tantalum used in these experiments was furnished by the Fansteel Metallurgical Corporation.

Metals for Buried Appliances.—The whole question of suitability of metals for use in the body can be stated briefly as follows:

There are many occasions in surgery when a buried appliance made of metal is highly desirable.

Until very recently, all the metals and alloys which had been used were capable of producing unfavorable tissue reactions in the body.

Now it is known that an essential of any metal for use in the body is passivity or freedom from electroactivity in the body fluids.

Only three materials generally available seem to possess sufficient passivity to be used safely in the body: "18-8-SMO" stainless steel, which is relatively inert and can be adapted for small appliances such as wire or screws; tantalum, which is inert and will be useful when production problems are solved; and vitallium, which is inert, has been used widely, and has been found to be perfectly safe for any type of appliance, except wire, which requires malleability strength and the essential biochemical resistance.

As new alloys are developed some material which is inexpensive, strong, malleable, and free of corrosion in body fluids will undoubtedly be discovered. If there is no electrolytic activity about it, it will meet the standards of passivity which have been established by the Fracture Committee of the American College of Surgeons, which standards serve as a guide for subsequent developments of metals for use in surgery.—Venable and Stuck, in *Surg. Gynec. & Obst.*, 76:303, April 1943.

THE ADMINISTRATION OF PENTOTHAL SODIUM IN SPECIALIZED OFFICE PRACTICE IN ORAL SURGERY

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RESEARCH work on pentothal sodium began in 1934. At that time, the Abbott Laboratories were experimenting with various barbituric acid salts in the hope that they would find a more nearly perfect intravenous anesthetic. In pentothal sodium, they found an anesthetic that more nearly fulfilled the requirements of this form of intravenous anesthesia.

This salt was found to be a powerful hypnotic, which broke up rapidly when injected intravenously. The fact that it was so rapidly destroyed in the body made it controllable, when injected slowly according to the intermittent technic of Lundy, and assured rapid recovery.

Pentothal sodium (sodium ethyl [methylbutyl] thio-barbituric acid) is a bitter lemon-colored powder, smelling slightly like sulfur. If in solution, it may safely be used for periods up to forty-eight hours, provided it has not become discolored.

Before 1940, whenever practicable, we operated under nitrous oxide-oxygen anesthesia. Since that time, pentothal sodium has replaced nitrous oxide-oxygen in the same proportion.

The reasons for this change were the ease of administration, the almost total absence of the excitement state, tolerance of the anesthetic by a larger number of patients and the almost complete absence of postanesthetic nausea and vomiting. While the equipment is not elaborate, the apparatus for the administration of nitrous oxide-oxygen and carbon dioxide is necessary. We also found that patients liked the anesthetic—that they had no recollection of going to sleep, although they would respond to suggestions from the nurse when asked to move a hand or a foot to aid in their removal from the surgery to the retiring room. We found that the alcoholic, the athletic or the otherwise resistive type of patient who was difficult to anesthetize under nitrous oxide and oxygen responded favorably to pentothal sodium. However, the alcoholic, athletic or nervous patient, although his recovery is rapid, may act as though he were under the influence of alcohol while recovering from the anesthesia. During the recovery period, the effects may take the form of drowsiness, with a desire to be allowed to sleep.

Pentothal sodium has been accepted by the Council on Pharmacy and Chemistry of the American Medical Association for use in short operative procedures, but not for use in the office. Because of its limited application in dentistry, aside from hospital practice, the Council on Dental Therapeutics has not considered pentothal sodium for acceptance.

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The patient may cry or sob, or may become talkative, seeking company, and sometimes the behavior is very unreasonable. While in the recovery room, the patient may throw or toss himself about, requiring watching.

In order that pentothal sodium may be administered successfully, hospital facilities, or their equivalent, are essential. Only those trained in the administration of other anesthetics should undertake to administer pentothal sodium.

When we first began the administration of pentothal sodium, we used a 5 per cent solution, then changed to a 2.5 per cent solution. We operated in 2,216 cases using a 2.5 per cent solution, then changed to a 2 per cent solution. We believe that the 2 per cent solution is the ideal one for oral operations. These conclusions are based on the following findings:

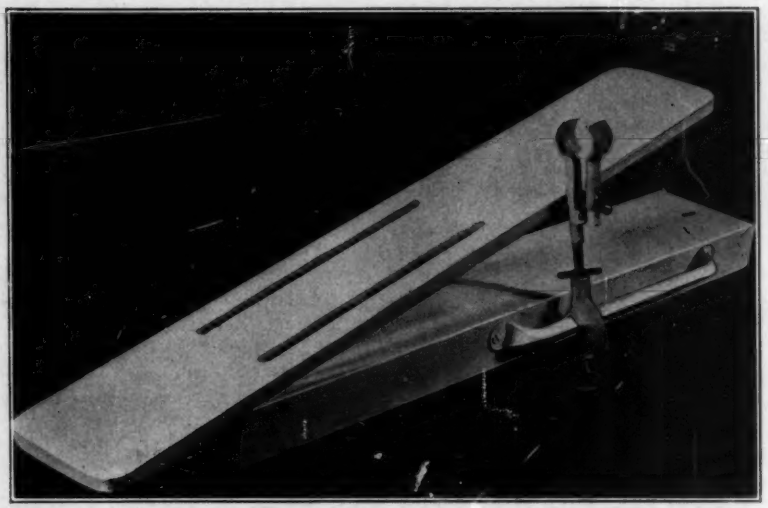

Fig. 1.—Arm board attached to arm rest of operating chair. Grooves are cut in the arm rest tilting board for insertion of cuff. A chemistry syringe clamp is attached to the iron bar.

1. We do not need either the depth of anesthesia or the degree of relaxation in oral surgery that is necessary in other forms of surgery.

2. Irritation to the arm is considerably less than it is with the more concentrated solutions. In fact, we have had only a very few cases in which the patient complained of soreness of the arm following venipuncture.

3. Cough reflexes, hiccuping and mild laryngeal spasms have shown a marked decrease.

4. The patient's reaction to the decreased percentage solution is slower,

making it easier to maintain anesthesia in the upper levels, bordering on analgesia.

PREPARATION OF PENTOTHAL SODIUM SOLUTION

In making a 2 per cent solution of pentothal sodium, the following procedure can be followed:

Ten cubic centimeters of sterile distilled water is aspirated into the eccentric tip of a 20-cc. syringe and is then discharged into an ampule containing 1 gm. of pentothal sodium. The ampule is agitated to dissolve the powder more rapidly. A long needle is used to reach the bottom of the ampule. The solution in the ampule is aspirated into the 20-cc. syringe and discharged into a sterile graduated container. To the 10 cc. which is now in the container, 40 cc. of sterile distilled water is added. This gives us a 2 per cent solution of pentothal sodium.

Fig. 2.—Patient's arm placed on arm board, with wrist cuff strapping arm to board.

The 10-cc. syringe is now filled with the solution to the 6 cc. mark, and the 20-cc. syringe also is filled. The nozzle of the 20-cc. syringe is capped with the hub of a broken Luer needle. (Fig. 6.) A 22-gage 1½ inch needle is now attached to the 10-cc. syringe. The end of the syringe is then placed in the broken end of the empty pentothal ampule in order to protect it from contamination.

We make up at least 500 cc. of pentothal sodium every day, following the technic as above described except that we use an ampule which contains 10 gm. of pentothal sodium. When the 10 gm. of pentothal sodium has dissolved, the solution is placed in the 500-cc. sterile container, and the container is filled to the 500 cc. mark with sterile distilled water. The

solution is then drawn from the container into the syringe, as shown in Figure 4, right.

PREOPERATIVE PROCEDURES

In an office practice, all patients are ambulatory. On making the appointment, they are warned not to eat anything for four hours preceding the operation. The stomach must be empty, likewise the bladder and rectum. Patients are instructed to attend to this eliminatory requirement immediately before the operation.

A history is necessary. If the patient is under a physician's care, a consultation should be solicited before the operation is undertaken.

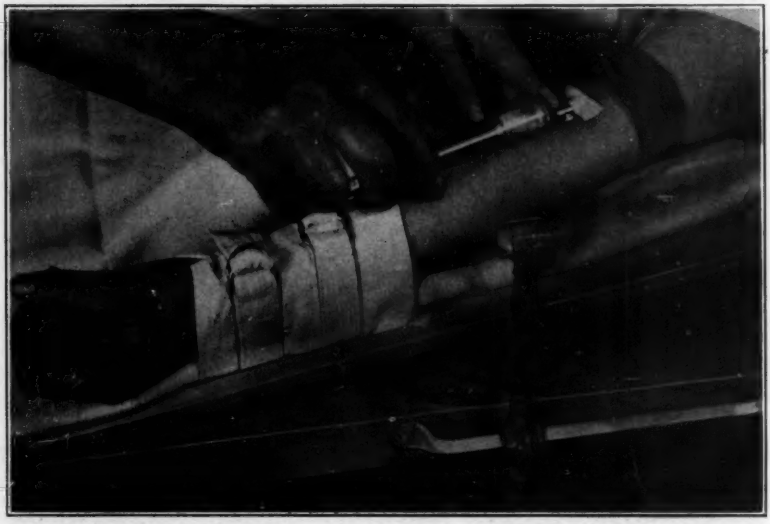

Fig. 3.—Tourniquet in place. A 10-cc. syringe is employed in venipuncture, with adhesive tape over the hub of the needle. The hand grasps an object in making a tight fist.

The blood pressure should be routinely taken. There is a decrease in systolic blood pressure from 10 to 20 mm. of mercury during the administration.

We very seldom employ premedication, although, in some cases, we have given one one-hundred-fiftieth grain of atropine sulfate thirty minutes before the operation, intramuscularly or intravenously, with the induction of pentothal. Pentobarbital sodium grains $1\frac{1}{2}$ is sometimes administered to nervous or apprehensive patients. Hubbell, of Long Beach, and Bullard, of San Diego, advocate the administration of morphine and atropine in certain types of cases. We have never used morphine in any case, although we

believe that such a procedure might be of advantage in certain types of cases requiring prolonged operations.

CONTRAINDICATIONS

If a patient has a history of certain types of blood dyscrasia, such as a marked lowering of the hemoglobin content, a diminution in the erythrocyte count or any form of anemia, care must be taken that the operation is of short duration and the anesthetic supplemented by nitrous oxide and oxygen. This type of patient and those with shortness of breath, or marked dyspnea due to some interference with the respiratory tract, should be hos-

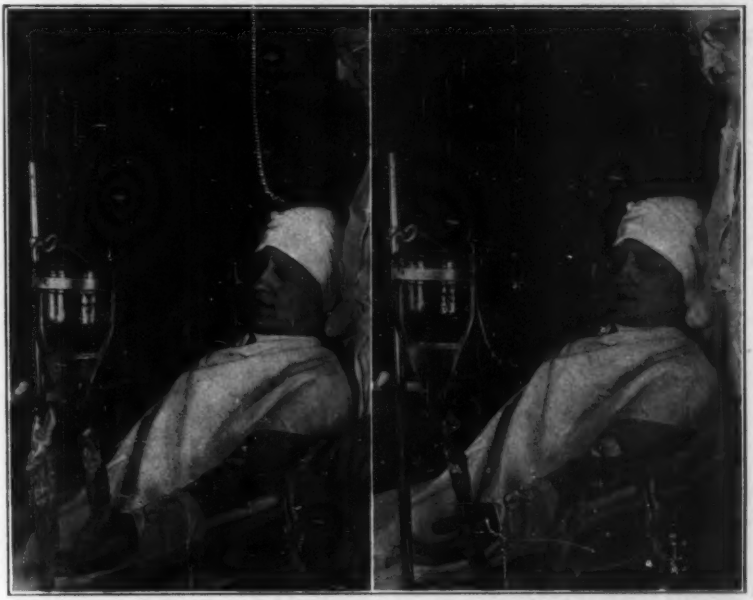

Fig. 4.—Left: Use of 20-cc. syringe with sterile rubberized silk covering, attached to chemistry clamp. Rubber tubing connects the syringe with the needle. A 500-cc. container with sterile tubing is covered with rubberized silk casing, to prevent contamination. Right: Withdrawal of pentothal sodium solution from 500-cc. container into 20-cc. syringe.

pitalized, as likewise those patients with a history of cardiac disease with decompensation. Pentothal sodium should never be administered when the stomach is full because of the danger of laryngeal spasm from regurgitation of food into the throat.

Bishop and Rudder, writing in the *Journal of the American Medical Association,* say:

A practice has been followed of restricting the use of intravenous anesthetics when one of the following situations arise: (1) the patient is under 15 years of age; (2) there are inflammations about the mouth and throat with potential encroachment on the upper respiratory tract; (3) there is reduced vital capacity; (4) advanced liver or kidney disease is present; (5) shock, hemorrhage or anemia is present; (6) there is severe diabetes mellitus; (7) the operation involves the skin primarily, and (8) the patient is ambulatory.

It is always necessary to take the history before administering an anesthetic. The patient is routinely asked if he is under a physician's care. If he is, the physician is consulted as to the general systemic condition and

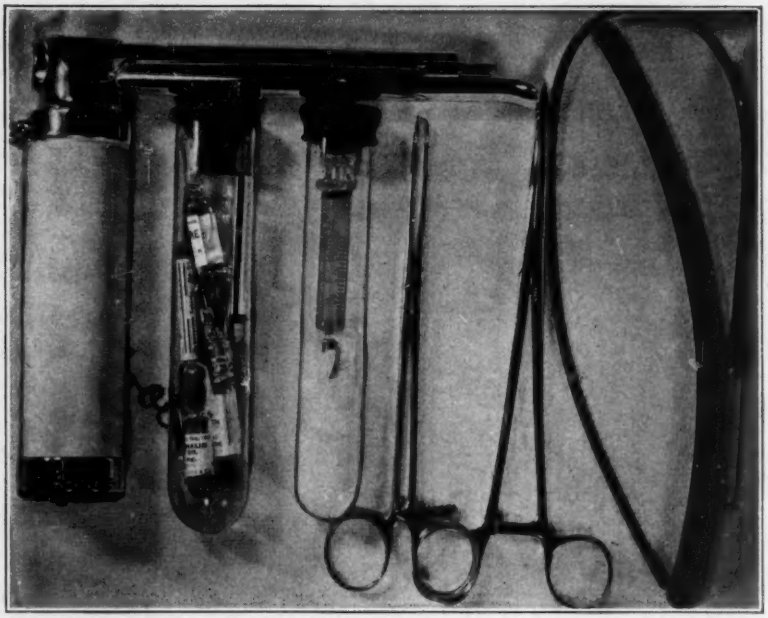

Fig. 5.—Left to right: Laryngoscope; glass tube containing adrenalin, atropine sulfate and distilled water; sterile glass tube containing sterile syringe and needle; forceps; French and endotracheal catheters.

is asked to designate the anesthetic of choice. The blood pressure is routinely taken. If the resistance is low, the patient is referred to a competent internist or to his own physician before a general anesthetic is administered or an operation is performed.

Children under 12 years of age are difficult to handle under pentothal sodium. Between the ages of 12 and 20 years, we find that, owing to the highly organized nervous system, the patient becomes restless under the

anesthetic. In these instances, we usually administer nitrous oxide and oxygen in various proportions, ranging from 10 per cent nitrous oxide and 90 per cent oxygen to 25 per cent nitrous oxide and 75 per cent oxygen, along with pentothal sodium.

We prefer to give children nitrous oxide and oxygen for the removal of teeth. The older patients and the debilitated ones seem to tolerate pentothal sodium well.

ADMINISTRATION

As has been said, pentothal sodium should be administered only by a

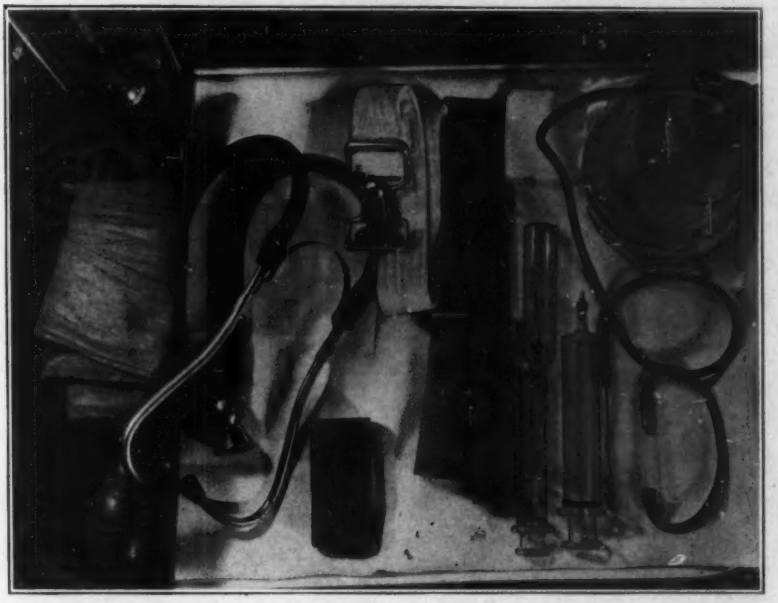

Fig. 6.—Left to right: Penrose drain used as tourniquet; 10-cc. syringe with 22-gage needle; 20-cc. syringe; rubber tubing with metal and glass adaptors; 500-cc. container with rubber and metal connector.

trained anesthetist with considerable experience in giving general anesthetics. I am indebted to Sophie Jevne, R.N., head anesthetist of my staff, for the considerable improvements and innovations in technic which her suggestions have established in our current practice.

The patient's arm is strapped to the arm board. (Fig. 2.) A heavy Penrose drain, used for a tourniquet, is placed above the cubital space. Because of having long finger nails, women find it difficult to make a tight fist, so we place a block of wood or a small round object in the palm of the hand

and instruct the patient to make a tight fist. The mouth prop is then placed in the mouth.

Venipuncture is made with the 10-cc. eccentric type syringe. Blood is drawn into the syringe to verify that the needle is in the vein. Adhesive tape is now placed over the hub of the needle and attached to the patient's arm to maintain the needle in place. (Fig. 3.)

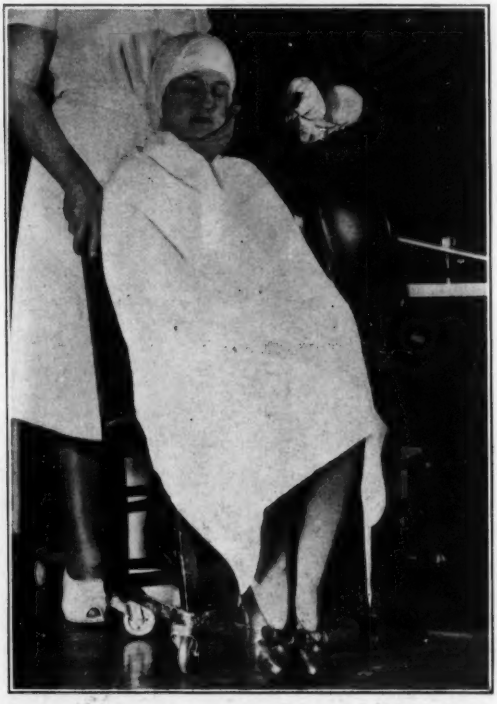

Fig. 7.—Patient seated in chair, chin supported by the nurse, and about to be wheeled to retiring room.

Two or 3 cc. is now injected slowly into the vein, and after a pause of from 15 to 20 seconds, the remainder of the 6 cc. of pentothal sodium can be injected. A second pause is made, the entire injection of the 6 cc. taking between forty and fifty seconds before the next injection is made. Some of this time is consumed in changing from the 10-cc. syringe to the 20-cc. syringe. The needle is left in place while the syringes are being changed. At this time, the tolerance of the anesthetic by the patient can be determined. The small air bubbles that sometimes accumulate in the syringe do not seem to affect the patient when injected along with the solution.

The rubber tubing and adaptors are attached to the needle and to the 20-cc. syringe, which has previously been attached to the chemistry clamp shown in Figure 4, left. Before continuing the injection of pentothal sodium, blood is again aspirated into the glass adaptor to determine whether the needle is still in the vein.

At first, we had the patient count aloud while the injections were being made. This is good practice until such time as the operator has gained sufficient experience with the anesthetic. Before going to sleep, the patient will usually yawn or take a deep breath. At this time, we usually give 1 or 2 cc. more of the solution, and then test with a sharp instrument the tissues which are to be operated upon, to ascertain whether any response to the stimulus develops. If there should be none, we can safely proceed with the operation.

The mouth is packed before the operation is started. A good aspirator is essential. Blood and mucus must constantly be aspirated. The mouth packs, as they become saturated with blood or mucus, should be changed. The constant changing of packs as they become saturated is very important, as any blood or mucus which enters the throat may bring on a laryngospasm, or coughing.

The headrest should be well forward under the back of the patient's head, as the jaw can be grasped and kept forward more easily in this position. By keeping the patient's jaw well forward, an adequate airway is more easily maintained. Under no circumstances must the jaw be allowed to sag back, as this will keep the free air from entering the lungs.

The anesthetist should stand at the head of the patient, where she can support the jaw, change the throat packs, administer the anesthetic and handle the aspirator.

The patient's color should remain pink at all times, and the respiration should be regular. The degree of relaxation of the jaws and the shallowness of respiration are indications of the depth of anesthesia.

In cases of coughing, cyanosis, lowering of respiration or laryngospasm, the anesthetic should be discontinued at once and oxygen should be administered. Cyanosis is usually brought on by an obstruction of the airway, by lowered respiratory function or by laryngospasm. If there is cessation of respiration, oxygen should be administered immediately and artificial respiration should be started at once. Five per cent carbon dioxide with oxygen is given in certain cases of shallow respiration.

The anesthetist should observe the color of the blood, of the skin and of the fingernails, as certain color changes are an indication of lack of oxygen or obstruction.

In shallow breathers, respiration can be felt by placing a hand on the abdomen. When in doubt as to whether the patient is breathing, stop the anesthetic and administer oxygen.

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In case the needle has not entered the vein, an extraneous injection having been made, hot moist applications should be placed over the site of injection, to reduce the inflammation and accompanying pain. If the solution has been deposited outside the vein and into the tissue, the skin will be raised and will appear puffy.

When the needle is withdrawn, a compress of gauze or cotton saturated with alcohol is pressed over the site from which the needle is being withdrawn.

Care must also be exercised in the palpation of a vein before venipuncture, as cases of injection of an artery have been reported. In some of our cases, we could see the artery pulsating alongside the vein. The injection of pentothal sodium into an artery can be fatal.

POSTOPERATIVE CARE

Retiring rooms are necessary when pentothal sodium is be to administered. After the operation, the patient is placed on an ordinary strong chair with rubber casters and wheeled to the retiring room. (Fig. 7.) The patient will assist in placing himself in the chair, but may have no recollection of doing so afterwards.

After the operation, the patient's mouth is wiped out with a gauze sponge to remove any blood or mucus, and fresh gauze is placed in the mouth over the area of operation, to prevent any seepage of blood or mucus into the throat. In the retiring room, the patient's head is turned to one side, so that any blood or mucus can flow out of the mouth. He should be kept under observation until he has regained consciousness. Most of our patients leave the retiring room after thirty minutes. If the operation has been long, the recovery period is greatly lengthened.

Upon returning to consciousness, the patient is given soup, tea or coffee. This seems to shorten the recovery period.

Patients should not be given pentothal sodium in an office unless they are accompanied by some person who will see that they are taken home. Patients should not be allowed to drive their own cars after the operation.

ADMINISTRATION OF PENTOTHAL SODIUM IN CAVITY PREPARATON BY COMPETENT ANESTHETIST WITH HOSPITAL FACILITIES OR THEIR EQUIVALENT AVAILABLE

In cavity preparation, the same procedure is followed, except that atropine sulfate one one-hundred-fiftieth grain is administered subcutaneously, to reduce the amount of saliva.

The throat is packed and mucus is aspirated. It is not necessary to carry the anesthesia to the same depth as in surgery of the mouth. The patient is kept in a state of analgesia, more or less. When patients have been kept asleep for longer than an hour, on completion of the operation we have

given picrotoxin intravenously, 0.003 to 0.006 grain, to shorten the recovery period.

STERILIZATION, CLEANSING AND CARE OF SYRINGES AND NEEDLES

Immediately after the removal of the needle from the arm, cold water is run through the tubing, the syringes and needle, which are all placed in a green soap solution until the actual time for cleansing and sterilization.

At the time of sterilization, the syringes are rinsed with hot water, then placed in an autoclave and left for fifteen minutes at 15 pounds pressure. The needles are syringed with hydrogen peroxide to disintegrate any blood that may be left in the shaft; then with benzine, to remove all fatty matter, and then with ether, to dry the shaft of the needle. A stylet is placed in the needle and they are then ready for the autoclave, fifteen minutes at 15 pounds pressure. Rubber tubing is also put through the autoclave for fifteen minutes.

SUMMARY

1. To date, we have operated in 8,203 cases under pentothal sodium in our office.

2. Only a trained anesthetist should administer pentothal sodium.

3. An adequate airway must be maintained at all times.

4. It is our belief that a 2 per cent solution meets anesthetic needs in the field of oral surgery.

5. Mucus and blood must be kept out of the throat by constant use of an aspirator and by changing the throat packs.

6. Pentothal sodium must be administered slowly and in intermittent dosages.

7. Children under the age of 12 should not be given this anesthetic.

8. The anesthetic should not be forced, but should be supplemented with nitrous oxide-oxygen in the resistive type of case.

9. Pentothal sodium is not contraindicated for the removal of teeth during pregnancy.

10. Most people tolerate the anesthetic satisfactorily, if it is properly administered.

11. In painful cavity preparations, pentothal sodium analgesia may be used satisfactorily under favorable circumstances, with adequate facilities and proper precautions.

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COMPLICATIONS OF ELECTROSURGERY AND THEIR TREATMENT

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ELECTROSURGERY is employed for various operations on the soft tissues in the oral cavity. The satisfactory results of such work have been mentioned in the literature, but little if anything has been said about its attending complications and untoward results. Delayed healing is not an infrequent postoperative problem.

Since there is a varying specific resistance of the several types of tissues, we are dealing with a non-homogeneous conductor; and the continuous change of the liquid contents of the tissues makes it difficult to evaluate the resistance of the tissues to the passage of the high frequency current.

This may help to explain why similar areas in different patients fail to respond in the same manner under identical applications of electric current. Uneventful healing takes place in some cases; whereas, in others, there have been observed slow-healing sloughed areas. Of course, excessive coagulation is also a factor in the delayed healing of such wounds. Some of these slow healing wounds have run a course of from two to seven weeks. Sequestration of the underlying bone, due to necrosis, has been observed in such cases.

The extent of tissue damage along the line of incision governs the rate of healing. The course of healing in electrosection is quite different from that in scalpel incisions. About four or five days after electrosection, the tissues become red and there is evidence of secretion. There may be some fine fringes of necrosed tissue at the edges that do not become approximated. The amount of necrosis is greater in muscle and connective tissue because of its greater resistance to the action of heat. Excessive coagulation may cause considerable necrosis of the other soft tissues of the mouth, especially when the electrode is applied too long, and if the milliamperage is too great for the area.

In one case in particular which was referred to us, the maxillary labial frenum was obliterated by coagulation. The wound spread as an ulcerated lesion from the median area to the left and right cuspid area. Some proprietary zinc oxide surgical paste dressings had been applied, but the condition was not controlled after three weeks of such treatment. Cod liver oil ointment dressings brought this widely sloughed area back to normal in two weeks. Slight sequestration was observed in this case, indicating that the damage was probably caused by excessive coagulation.

A thin splint of transparent acrylic resin accurately formed holds the cod liver oil ointment in contact with the lesion area. The oil forms a protective membrane over the wound and promotes epithelization and collagen regeneration.

The efficacy of the local treatment of complicated burns, third degree and less severe, has been brought out in the medical literature. Lesions resulting from prolonged x-ray irradiation, and burns caused by accidental contact with high voltage electric current, have also been amenable to local treatment with cod liver oil. Osteomyelitis has been successfully treated with the oil. After the treatment is applied, there is granulation, with epithelization. In view of the great possibility of complications in electrosurgical treatment of oral conditions, it is obvious that an effective form of therapy should be available for such conditions.

Cod liver oil is sterile and bactericidal. Treatment with cod liver oil is painless and non-irritating. The treatment inhibits the growth of bacteria, preventing secondary infection. It effects rapid granulation and epithelization, with resultant rapid regeneration of tissue defects.

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EXTERNAL SKELETAL FIXATION OF FRACTURED MANDIBLES*

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DURING the first World War, great numbers of maxillofacial injuries were seen. Most of the principles in use today in fracture treatment were established at that time.

During the present war, external fixation of fractures has been used. The method is not new. It was employed for the treatment of fractures of the long bones by Parkhill[1] and by Lambotte,[2] whose appliances closely resembled those of the present day. Lambotte states that Malgaigne and Rigal had used similar methods. Lambotte's apparatus used by him in the last war consisted of two parallel threaded pins, introduced with a hand drill, two pins holding each fragment. The two pin-units were connected by what he named the "fixateur." In spite of the good results reported by Lambotte, the method failed, because of electrolysis, rusting and infection, to come into general use, until the advent of stainless steel. Recently, Roger Anderson,[3] after an extensive experience, showed all the possibilities of the method of external fixation of fractures.

In August 1940, a group of surgeons left New York for England under the leadership of Philip D. Wilson. This unit, named the American Hospital in Britain, was equipped mainly for three types of surgery: orthopedic, plastic and neurosurgical. In the equipment was the Roger Anderson apparatus for external fixation of the long bones. These appliances proved very successful in the treatment of complicated compound fracture of the long bones, which was often accompanied by great loss of skin and muscle, in air raid casualties.[4] The results prompted Waknitz to make a reduced type of apparatus of the converging pin Anderson type for use in fracture of the metacarpals and phalanges. It was this appliance that was first used in the treatment of mandibular fractures.[5] The method was particularly valuable in England because of the great numbers of edentulous patients. Enthusiastic support was given to the method by Sir Harold Gillies, who contributed greatly to its rapid dissemination and who warned of its dangers.[6] During the past two years, external fixation of jaw fractures has been applied extensively in the United States as well as in Great Britain, and its various applications have recently been excellently reviewed.[7] From my personal experience and my observation of cases, it appears that certain mistakes are made in application of the treatment, which may tend to discredit the method.

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The three most common causes of failure in application are the following:

1. Infection. Fixation by external pinning is a surgical procedure. External fixation should be carried out by two operators, one working extra-orally, the other, intra-orally. The former, following an aseptic technic, does the pinning, avoiding all contact with the oral cavity.

The latter manipulates the fragments within the mouth and helps to direct the operation. The pins, after they have been inserted, should be left undisturbed for several days. The patient should be warned against touching the pins or the dressings.

A poor site for pin insertion is the symphysis, its situation rendering it liable to contamination by saliva or food. Also, in this region, the pins

Fig. 1.—Original Converse-Waknitz appliance.

Fig. 2.—Patient with appliance in position. Plastic was used to reinforce the appliance.

transfix the fat pad of the chin. This pad consists of dense, poorly vascularized fat, prone to infection. To avoid oral contamination, and to bypass the fat pad of the chin, the pins are, preferably, introduced into the lower border of the mandible; obliquely to avoid the roots of the teeth.

2. Ulceration of the skin. A common cause of serious ulceration of the skin is the use of the pin-unit as a means of reducing a markedly displaced fragment. The skin may be stretched and twisted, and the pressure caused by the pins leads to ulceration and infection. It must be emphasized that

the method of external pin fixation is, as its name implies, intended essentially for fixation rather than for reduction. Reduction should be effected by the operator working intra-orally, who immobilizes the fragments while they are being pinned. A minor adjustment can later be carried out by means of the actual appliance to achieve an anatomic reduction, often after verification by means of an x-ray film.

Another cause of ulceration is faulty technic in the use of appliances in which the two converging pins are held by a single unit (Army type). In such appliances, the pins should be drilled through the twin pin-unit while the latter is held against the skin. Failure to do this will necessarily mean that the pins cannot be held by the unit unless they are bent or arched into proper position; this producing skin tension, a danger which does not exist in the newer appliances in which universal joints hold the individual pins.[8]

3. Insufficient insertion of the pins. This is a frequent mistake of beginners. The movement of the pins may cause the detachment of a piece of bone between them. Each pin must drill through the outer cortex and the medulla into the inner cortex. A characteristic sensation is experienced, first of resistance, as the pin penetrates the cortex; then a give, as the pin enters the spongy bone; followed by resistance when the cortex is again encountered.

These are the most frequent causes of failure. Other complications may occur; i.e., penetration into a tooth root or into the inferior dental canal, with resultant pain. The transfixion of the parotid gland often is followed by a salivary leak around the pins, which, as a rule, will cease, if not within a few days, always after the pins have been removed.

A number of other points have been noted in external fixation of the mandible.

1. Aseptic necrosis due to the heat produced by the high revolution of the pins by an electric engine. An electric drill may be used at slow speed. It is important to use sharp pins with triangular points. Roger Anderson and Finlayson[9] recently noted that a considerable amount of heat is produced by the friction of dull pins.

2. The size and number of the pins. Whenever possible, fine pins (1 mm.) should be used. They cause less reaction in the skin than thicker pins (2 mm.) The appliances should be so contructed that pins of various sizes can be used, in accordance with the needs of the individual case. In some cases, one of the pin-units can be eliminated. The control of a posterior edentulous fragment is often possible by a single pin-unit based on a mandibular dental splint. Care must be taken that the extension from the splint does not cause pressure on and ulceration of the lower lip.

3. The direction of the pins. When it is desired to obtain maximum control of a fragment in the frontal plane, the best results are obtained

by converging the pins in the bone. Complete control of a fragment in the sagittal plane, for example that of a lingually displaced posterior fragment, is approached when the pins are crossed before they enter the bone.

4. External fixation in the delayed treatment of fractures. A swelling due to edema should be carefully distinguished from the firm mass of a hematoma. Hematomas, if transfixed by the pins, are prone to infection. It is wise to place the pins at a distance from the swelling.

5. The necessity of impacting the fracture. External fixation is an excellent means not only of holding the fragments together (impaction), but also of holding them apart (distraction). Firm impaction must be assured before the connecting rod between the pin-units is locked.

6. External fixation by other means than converging pins. Descriptions of appliances utilizing parallel screws[10] showed that it was necessary to make small incisions to introduce the screws through the skin and, because of their larger size, a greater amount of reaction was noted in the tissues. The use of only one screw in a fragment failed to give complete control.

It seemed preferable, instead of using screws, to add a thread to the converging pin, as suggested by Roy A. Stout. In this manner, when desired, the pin can be slowly screwed into the bone. External fixation by means of a transverse Kirschner wire drilled through the fragments[11] was found to be useful in certain cases, when a reinforcement of the fixation method used (interdental wiring, splint) was needed. The method fails to prevent distraction or rotation of the fragments unless interdental wiring or splinting of the fragments is possible.

7. The size of the appliance. Most appliances are too large and too heavy. Many of the patients are ambulatory. With a small and light appliance, the patient's comfort is increased, while his self-consciousness is decreased.

CONCLUSIONS

External skeletal fixation by the converging pin method of Roger Anderson is a valuable addition to methods of treatment of fractured mandibles. After two years of experience, the method is finding its place among accepted methods of treatment. Its use is fraught with certain risks, which should preclude its employment in inexperienced hands and reserve its application to a number of indicated cases.

External fixation is indicated for:

1. The control of one, two or multiple edentulous fragments in early and delayed treatment of mandibular fractures, simple or compound.

2. The control of fragments after loss of bone substance due to enemy action or the control of fragments during reconstructive bone-grafting.

3. Cases in which occlusion of the jaws is contraindicated or undesirable (bronchiectasis; early evacuation of wounded by air or sea).

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Bacteria and the Surgeon.—Surgeons are constantly encountering problems of sepsis, asepsis and antisepsis. In spite of this fact, there are too many surgeons who know too little about bacteria and their habits. Frequently they take cultures from wounds or exudates but pay little or no attention to even the laboratory report of the findings, let alone making any practical use of it. Too often, they regard the bacteriologic problem as being an academic one, apart from the clinical aspect of the case, something for the laboratory technician to work out, and for the hospital superintendent to report in the analysis of cases. This, of course, is not true, for the whole science and art of surgery depends so greatly on bacteriology. Without asepsis, practically the whole field of elective surgery would collapse. The intelligent care of infected wounds demands a thorough knowledge of bacteria, how they grow or how they may be inhibited. Who is in better position to make contributions in this field than the surgeon who sees and dresses the wound, or who opens and drains the abscess, and follows the clinical progress of the patient? Certainly not the laboratory technician or the bacteriologist whose chief interest is often concerned with the staining reactions of the organism, its reaction to culture media, to oxygen tension, and other similar qualities which allow it to be diagnosed and classified.—*Surg., Gynec. & Obst.*, 76:635, May 1943.

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FRACTURES OF THE FACIAL BONES IN CHILDREN

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SINCE the motor car accident of today involves all age groups, children may be included in those sustaining serious and often multiple fractures of the facial bones in these accidents. They may be struck by cars or may sustain injuries of the guest passenger type; for children are restless and seldom sit quietly or keep alert to brace and protect themselves in case of a collision. An impact against the steering wheel and post may cause injury to a child when he has himself started a car or when he is sitting on the driver's knee.

Being venturesome, children may slide or fall from moderate heights to strike projections or the ground with considerable force; and they may sustain fractures while at play or be injured by various animals or by flying objects.

The mass bombings of civilian areas in the present world conflict may cause facial injuries in children identical to those sustained by men in actual combat.

Diagnosis is made by the usual methods of inspection, palpation, study of the occlusion of the teeth and x-ray examination. Postero-anterior and lateral jaw roentgenograms are made routinely, and intra-oral dental films are necessary in many cases.

Fractures of the mandible in infants occurring before the eruption of the deciduous teeth are rare, though Brophy[1] reported a great number of cases of birth injury fracture collected from the literature. These were breech presentation cases necessitating an unusual amount of forcible finger traction for delivery. We have not seen any cases of this type, nor have we had any called to our attention.

Should fractures occur before a sufficient number of teeth have erupted to permit wiring or splinting, treatment is usually limited to manipulation or molding of the fractured parts into alinement, supplemented by external support. (Case 1.) Ace bandages may be used, reinforced, if necessary, with narrow strips of adhesive tape. A headcap chin support made of starched or plaster of Paris bandages may be found more efficient, and necessary to maintain support of the mandible with a minimum amount of movement. Union of the fracture usually proceeds without complication. In the event of marked displacement of the fragments of the body of the mandible, the best method of treatment is circumferential extraperiosteal wiring over a splint constructed to fit the alveolar process ridge and such

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teeth as may have erupted. This method will be described later. Fortunately, such marked displacement is rare in infancy. Sedation with 20 to 30 grains of chloral per rectum is usually satisfactory for the treatment outlined in uncomplicated cases in infants.

In children 3 to 11 years of age, all of the deciduous teeth have erupted, and in children of 7 years and older, one or more of the first permanent molars in addition. Consequently, the methods of treatment usually employed in adults, such as loop[2] or Risdon external arch wiring, may often be found effective for fractures in children. (Fig. 1, A and B.) Risdon arch wiring

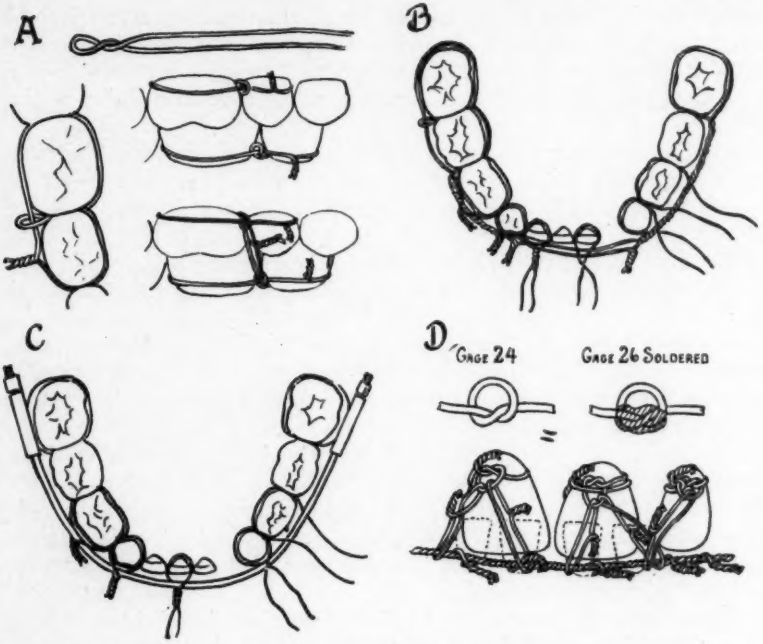

Fig. 1.—Diagram of (A) loop method of wiring, (B) Risdon external arch wiring, (C) orthodontia bands and external arch and (D) indirect dental fixation by tie wires.

may be made secure on the deciduous teeth in many cases where loop units cannot be used on account of spaces between the teeth. Recently, one of us (R. G. P.) employed modified loop wiring in two cases of fracture of the mandible. A single tie forms a loop for the insertion of tie wires. If 26-gage wire or finer wire is used, it is necessary to solder the tie-loop to prevent its closure when tightening the wire around the tooth. Loops may be quickly soldered by using a tiny strip of x-ray film metal backing with a drop of zinc chloride solution and a bunsen burner. This type of wiring

on individual teeth with open contacts or used as a loop unit on two adjoining teeth has proved to be secure, and the loops remain close to the gingival margin. This provides ample vertical height for tie wires and in no instance did the loops pull toward the occlusal plane to any great

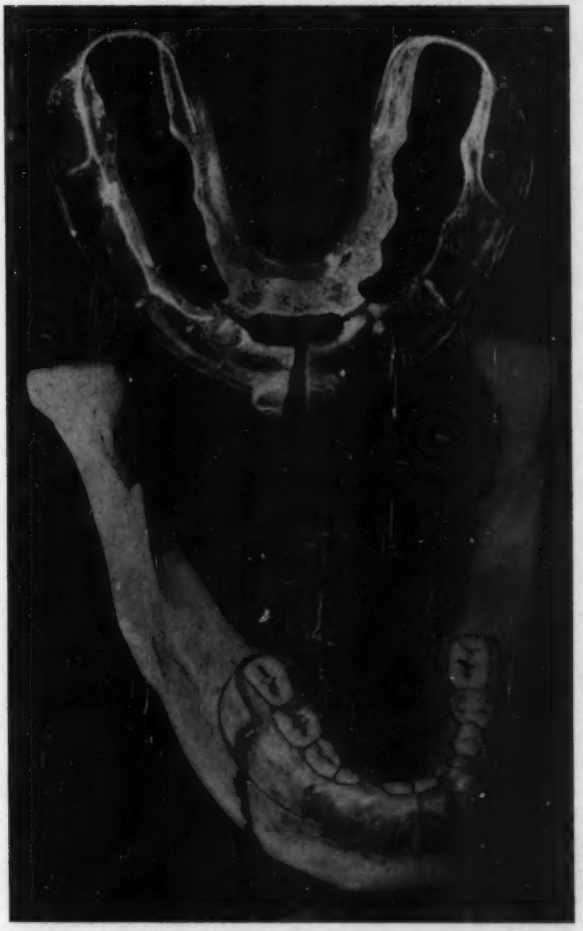

Fig. 2.—Direct dental fixation of fracture of mandible (Class I) by means of clear acrylic resin splint.

extent. This method may also be used with a continuous wire with two or more tie-loops on a number of adjoining teeth, thus reducing the number of twisted ends. (Fig. 1, D.)

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The shape of the crowns of the teeth and the lack of tight contact points between the deciduous teeth may necessitate the use of orthodontic bands[3] fitted to the teeth and an external arch bar. (Fig. 1, C.) Should this appliance prove insecure, splints of cast metal, vulcanite or clear acrylic resin[4] must be constructed.

It must be noted that many older children cooperate remarkably well in fracture treatment, measuring up, in the average experience, to adult patients. General anesthesia, however, is usually necessary in fractures presenting marked displacement.

Fractures through the body of the mandible in young children usually

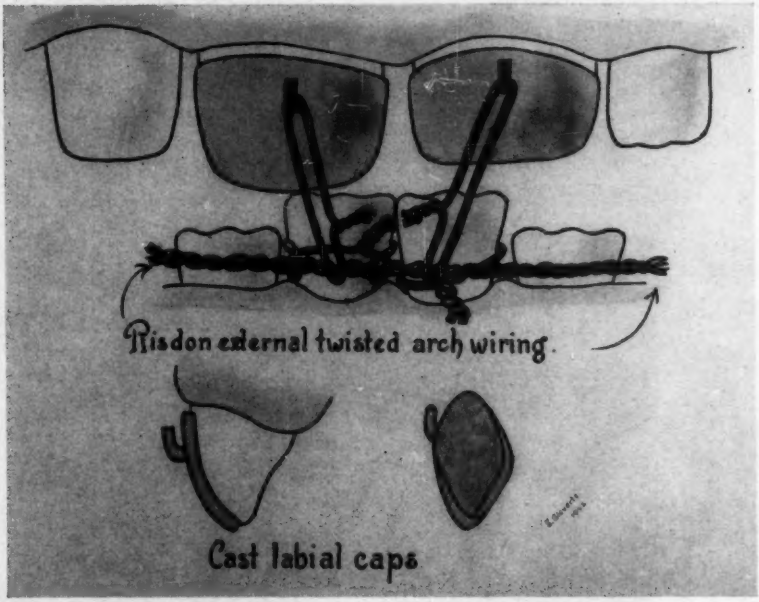

Fig. 3.—Useful method of securing tie wires to deciduous teeth crowns of which do not afford retention in commonly used methods of wiring.

involve not only the erupted deciduous teeth in the line of fracture, but also one or more underlying permanent teeth. Such teeth developing in the body of the mandible generally show remarkable resistance to injury and infection. Unless displaced sufficiently to interfere with the reduction and realinement of the fragments, they should be left in position when the fracture is immobilized. Even when a moderate degree of infection develops, with sinus formation, the teeth usually continue to form roots and later to erupt if adequate drainage is maintained as long as is neces-

sary. This fact corresponds with the experience of oral surgeons in the treatment of osteomyelitis of the jaws in children. A dentigerous cyst may subsequently develop as in Case 2. This is undoubtedly a rare, late complication due to the effect of the traumatism upon the epithelial tissues of the enamel organ of the developing permanent tooth.

As already noted, the routine methods of wiring the teeth in occlusion by the use of loop units or the external twisted arch wire described by Risdon[5] afford secure and effective immobilization in many cases of fracture in children. The Risdon twisted arch wire is usually more efficient, as it is wired to each tooth and therefore can be employed when the anterior teeth are widely spaced on account of the normal growth of the jaws.

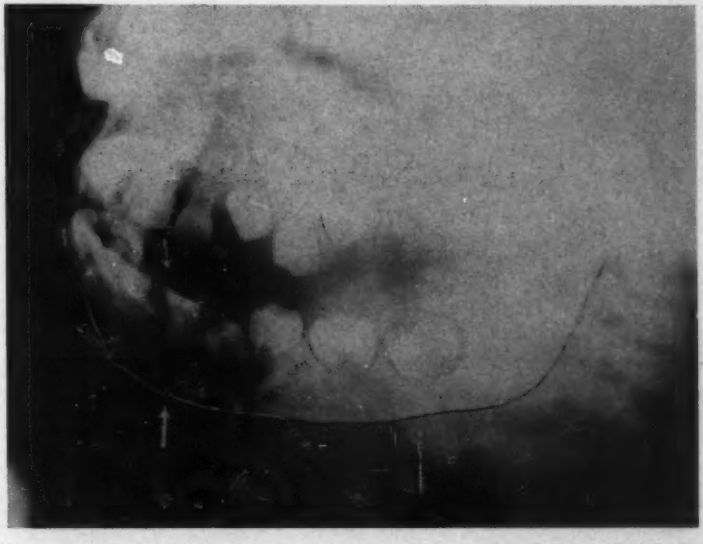

Fig. 4 (Case 1).—Oblique lateral roentgenogram showing fracture in left incisor region with lingual displacement of posterior fragment.

It must be emphasized that in some cases there is great difficulty in immobilizing and holding the teeth in occlusion during repair of the fracture. For example, loop units, a Risdon external arch wire or a band and arch bar splint (Fig. 1) may be securely applied to the teeth on the lower jaw in children when the upper anterior teeth are missing or loosened or are but partially erupted. Furthermore, the shape of the crowns of the upper incisor and cuspid teeth often makes effective attachment of wires impossible. Consequently, anterior tie wires cannot be used to hold the teeth in occlusion. Bandage support of the teeth of the mandible against

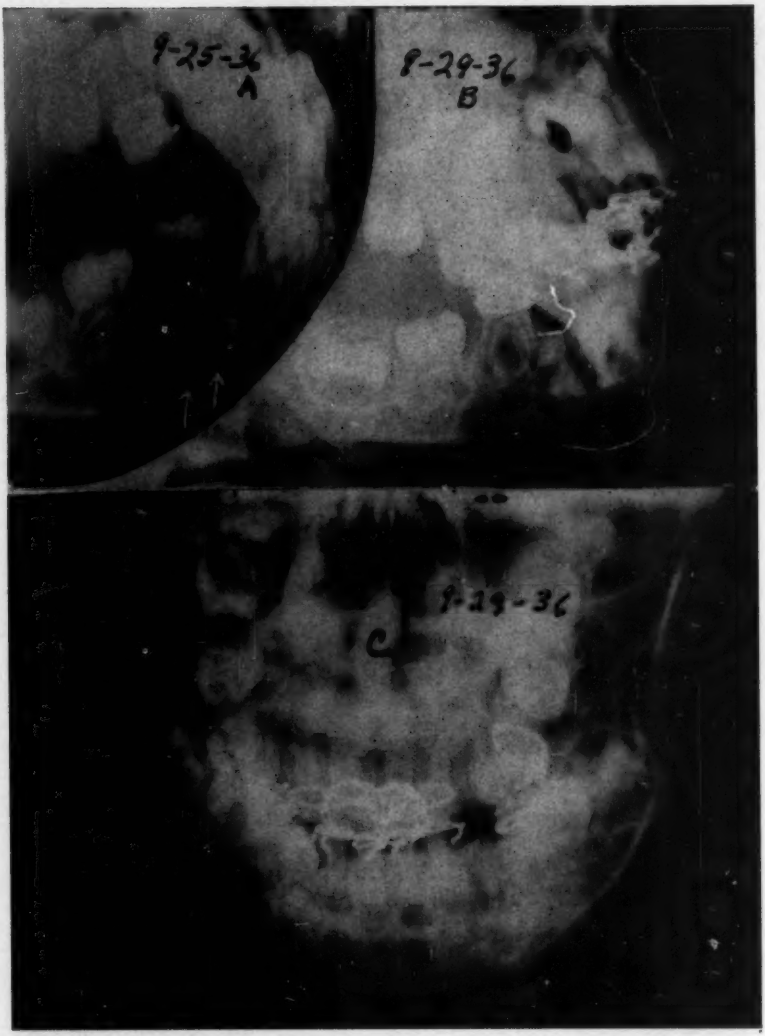

Fig. 5 (Case 2).—A. Lateral roentgenogram showing marked comminution. B. Lateral roentgenogram showing interdental loop wiring. C. Postero-anterior roentgenogram showing interdental loop wiring.

those in the maxilla should be tried and will usually be found satisfactory in Class I fractures that do not present much, if any, mobility and displacement. In displacement cases with considerable mobility and in frac-

ture distally from the teeth, immobilization should be established by securing the teeth in occlusion. If the available upper anterior teeth present sufficient labial surface, one or more cast silver, or preferably gold labial caps with loops or hooks (Fig. 3), may be cemented in place to afford the necessary attachment for anterior tie wires or rubber bands. This method of treatment was used with success in Case 5. The labial cast caps will usually hold securely for the four to six weeks necessary for maintenance of the teeth in occlusion. Should they become loosened, they can be recemented without difficulty.

If the simple methods thus described are not applicable, impressions of the upper and lower teeth should be taken from which casts can be made. These casts should be duplicated, the original casts being used for study

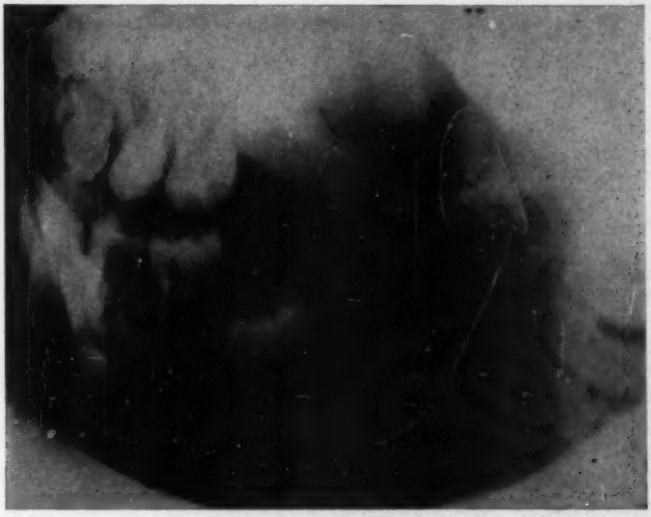

Fig. 6 (Case 3).—Lateral roentgenogram showing fracture of neck of right condyle.

and records. In case of displacement, the duplicated cast of the fractured jaw may have to be divided at the site of the lines of fracture and reassembled in proper occlusion with the cast of the opposing jaw. This reassembled cast is then used for the construction of a suitable splint, which may be made of cast silver, vulcanite or a clear acrylic resin. (Fig. 2.) The last is preferable in that it is transparent and does not obstruct the roentgen rays. The splints should have suitable hooks or loops for the attachment of tie wires or rubber bands from the splint to the wiring or a splint on the upper teeth. The splint should be cemented to the teeth if possible, although frequently secure cementation may be found imprac-

ticable on account of the patient's general condition or difficulties in controlling moisture or slight bleeding in the mouth. If this is the case, the splints may then be wired to the teeth to afford satisfactory, though somewhat less secure immobilization. When the line of fracture is through the body of the mandible with teeth on both sides (Class I) (Fig. 1, B), the splint provides direct fixation of the fracture. In such cases, the tie wires securing the teeth in occlusion may be divided two or three weeks earlier,

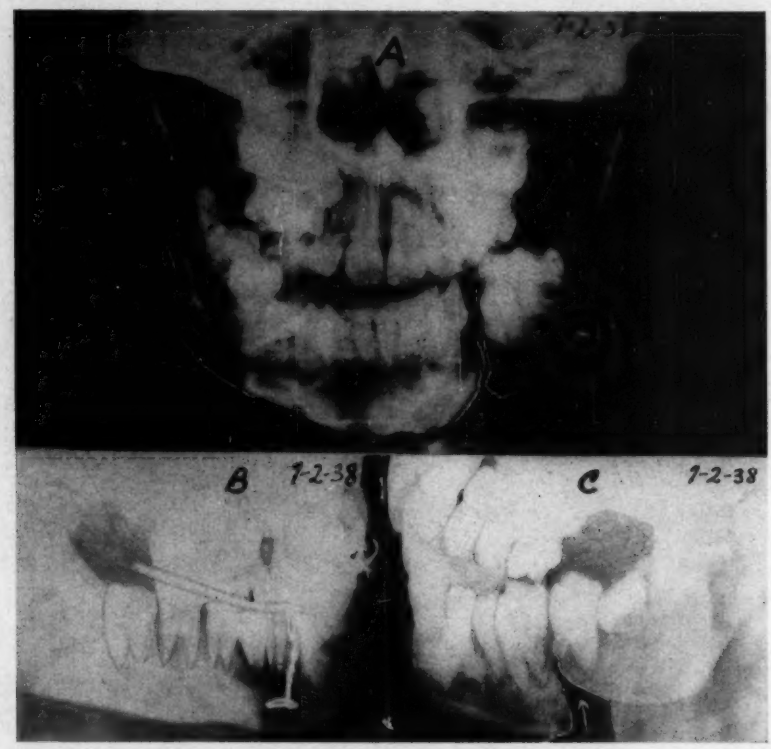

Fig. 7 (Case 5).—A. Postero-anterior roentgenogram showing bilateral compound fractures of mandible. B. Right lateral roentgenogram showing arch bar and loop wiring with direct surgical bone wiring through lower border. The twisted end of this wire was left long enough to encourage drainage, and facilitate removal of the wire. C. Left lateral roentgenogram showing fracture distally from erupted first molar tooth. The upward displacement of the posterior fragment makes the unerupted second molar appear to be at a normal occlusal level in the arch.

usually from the third to the fifth week, the time depending on the original amount of displacement and mobility of the fragments. The splints are

left on the teeth for an additional period of two or three weeks to give direct support and fixation in the later stages of consolidation. During this period, the child may be permitted to open the mouth and enjoy a more liberal, though soft diet, not requiring mastication.

If the planes of the fracture lines, the displacement and the condition of the teeth make necessary the construction of splints, and it is the found impossible to secure such splints in position by cementation or wiring to the teeth, the method of extraperiosteal circumferential wiring is indicated. This wiring method was originally described by G. V. Black. The fragments are pulled up into the splint by means of wires that pass around

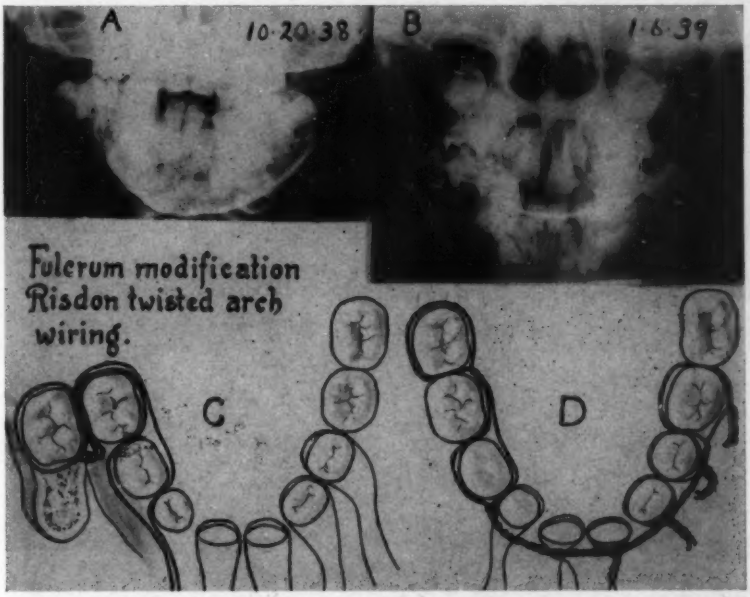

Fig. 8 (Case 6).—A. Postero-anterior roentgenogram showing complete buccal overriding of posterior fragment, one month after injury. B. Postero-anterior roentgenogram showing immobilization by fulcrum external arch wiring and interdental fixation by tie wires. C, D. Diagrams of fulcrum modification of Risdon external arch wiring. For demonstration purposes, the wires are not shown pulled tight around the teeth.

the mandible outside the periosteum, to be twisted over the labial and buccal surfaces of the splint. This method is very efficient, but we do not feel that it should be used in nearly every case of fracture in children as has been suggested by certain authors,[6] for we have found that the more conservative methods heretofore discussed are altogether satisfactory, less complicated and more comfortable. One can usually determine quickly

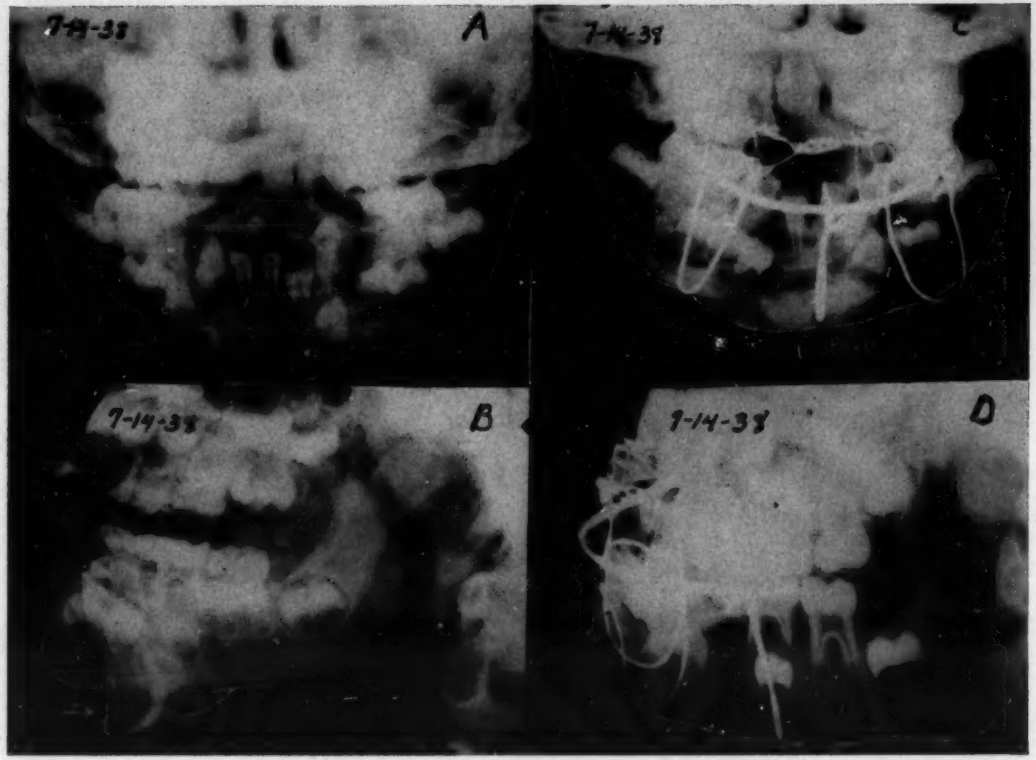

Fig. 9 (Case 7).—A. Postero-anterior roentgenogram showing bilateral fracture of mandible. B. Lateral roentgenogram showing marked downward and distal displacement of central fragment. C. Postero-anterior roentgenogram showing circumferential, extraperiosteal wiring and teeth wired in occlusion over external arch bar splint ten weeks after surgical reduction of fracture. D. Lateral roentgenogram showing circumferential wiring and arch bar splint.

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that the use of simple loop or arch wiring or orthodontic appliances will probably not be successful and can undertake the construction of splints without delay. If splints cannot be cemented or secured by wiring, one can proceed with circumferential wiring without loss of time. The technic of extraperiosteal wiring is relatively simple, causing little surgical trauma. (Figs. 9 and 10.) The wire can be readily passed around the body of the mandible by means of a slightly curved antrum trocar cannula of small size and diameter. The mucous membrane on the lingual surface of the jaw is punctured close to the bone and the instrument is passed downward just lingually from the periosteum until the point of the trocar can be felt through the skin beneath the jaw. A very small submandibular incision is made through which the trocar is pushed to expose the end of the cannula, and the trocar is withdrawn from the cannula. Silver wire, gage 21, or a rustless steel wire, gage 24, is then passed through the cannula and the ends are left long. The cannula is then withdrawn and slipped over the trocar, and the procedure is repeated on the labial surface of the jaw. The instrument is manipulated to direct the point through the previously made skin incision. The lower end of the wire is then passed up through the cannula on the labial aspect and the cannula is again withdrawn. The wire now completely encircles the body of the mandible outside the periosteum and the ends of the wires are on the labial and lingual aspects of the previously constructed splint or appliance.

It is generally necessary to insert more than one circumferential wire in order to secure adequate immobilization; and in cases of bilateral fracture with depression and distal displacement of the central fragment, three wires are necessary, as shown in Figures 9 and 10, Case 7.

If there should be additional fractures in the region of the angle, the ramus or the condyle, with posterior displacement of the body of the jaw that resists reduction, a traction wire of gage 24 rustless steel should be passed through the loop of the anterior circumferential wire before it is pulled inside the incision against the lower border of the jaw. This traction wire (Fig. 10, F) will be found of great service in pulling the symphysis forward to its normal position and holding it there by means of a headcap appliance carrying an extension in front of the chin.

In uncomplicated cases, union of the fracture should be sufficiently strong in five or six weeks to permit removal of the splints and wires. The roentgenograms are, however, not conclusive, and may be misleading regarding the progress of union. Therefore, it is better to play safe by leaving the wires on an additional week or two. General anesthesia is usually necessary for the removal of the circumferential wires, and further wiring or splinting is disturbing to the child patient. One should, therefore, be reasonably sure that sufficient union has taken place to prevent any displacement by muscle action after removal of the splint and wiring.

ing circumferential, extraperiosteal wiring and teeth wired in occlusion over external arch bar splint ten weeks after surgical reduction of fracture. D. Lateral roentgenogram showing circumferential wiring and arch bar splint.

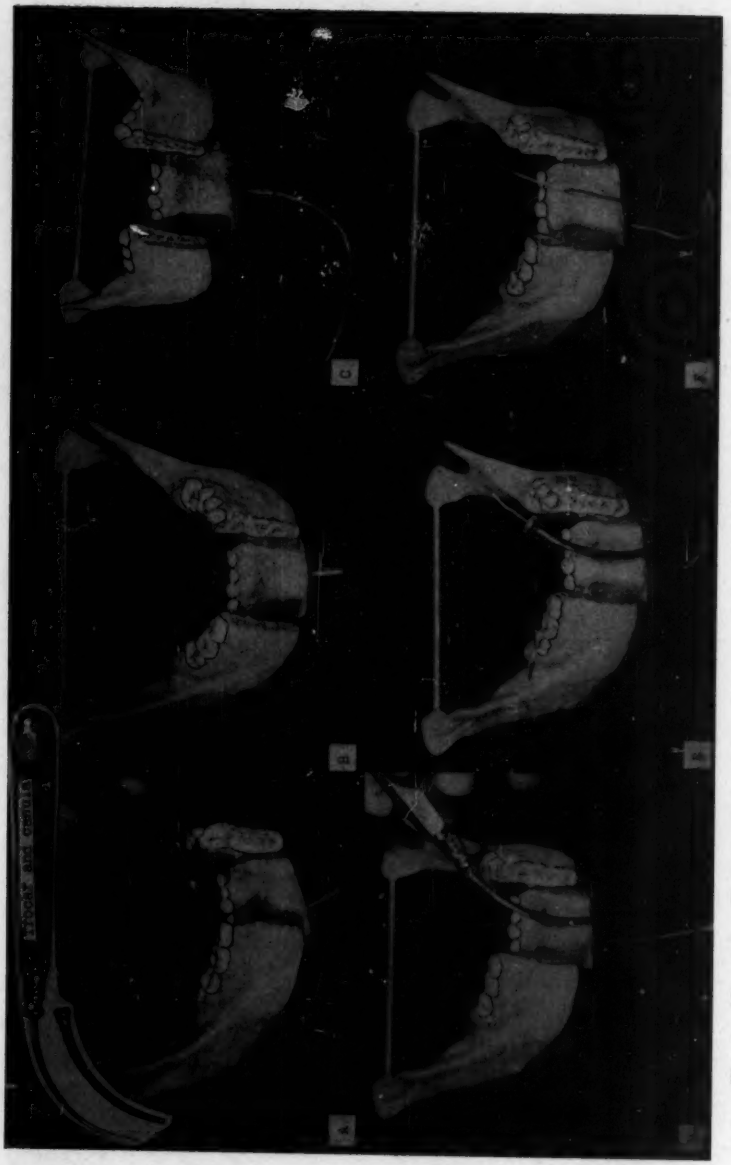

Fig. 10 (Case 7).—Technic of circumferential, extraperiosteal wiring and splint fixation. (Continued in Figure 11.)

Fig. 11 (Case 7).—Technic of wiring and fixation. (Continued from Figure 10.)

Case 7 illustrates this problem, and the need for careful examination and determination of the degree of union by manipulation after untwisting the wire over the splint and before the wires are removed from the tissues.

Fractures of the mandible distally from the alveolar process ridge which involve the angle or ramus (Class II, B) usually present but minor displacement in children. Union progresses without complication after the fragments have been manipulated into position, and the body of the mandible is held securely by the methods already outlined. In case of marked mobility and displacement, the planes of the line of fracture may favor the recurrence of forward and upward displacement owing to the pull of the masseter and internal pterygoid muscles. One must then resort to some method of surgical fixation to hold the posterior fragment in its proper position, for the intra-oral posterior extension found of service in adults is not so readily adapted to such cases in children.

During the past two years, numerous articles have been published on the subject of skeletal fixation in the treatment of fracture of the mandible by transfixation of bone by means of pins and screws. It has been stated that the method is not applicable to such fractures in children on account of the danger of injury to the developing permanent teeth in the body of the jaw. Pohl has described a hook-screw appliance adapted from the malar fracture appliance of Bruhn's, which does not penetrate the bone. We are having hook-screws constructed that may be connected with the Roger Anderson skeletal fixation splint. We are sure that these will be useful in cases of extreme displacement in fracture of the body of the mandible in children, particularly those fractures too far distally for the effective use of circumferential wiring over a splint. It will also be of great service in cases of fracture through the angle and ramus that present buccal and upward displacement. Fortunately, such cases are very infrequent, but they may easily occur, and one should be prepared to immobilize the fragment in alinement.

It may be advisable to insert the hook-screw near the posterior border of the ramus and fix the posterior fragment to a horizontal arm passing through the lips to be attached to a splint on the lower teeth. The insertion of a hook-screw in the anterior fragment is thereby avoided. It is wise to give additional support to these appliances by wiring, or at least by bandaging, to hold the teeth in occlusion for two or three weeks. This method is simpler than surgical exposure of the fracture line, which involves drilling holes and wiring the fragments, and infection and consequent complications are less frequent.

Children may sustain fractures of the condyles from blows or falls. Lateral displacement may prevent the closing of the mouth in normal occlusion, and the roentgenograms may present a most alarming appearance of displacement, overriding, crushing impaction of the head and disarrangement of the temporomandibular joint. The routine treatment is to correct

the displacement of the body of the jaw by securely wiring the teeth in occlusion with a 2 or 3 mm. thickness of rubber interposed between the posterior teeth on the side of the fracture. This acts as a fulcrum to assist in correcting the overriding of the fracture. The tie wires may be divided in three weeks and the child may eat soft food. Should malocclusion recur, oblique rubber band traction may be necessary for an additional week or two. Open surgical operations for improvement of the position of the fractured head of the condyle, after a thorough trial by many surgeons, have been given up as ineffective and subject to serious complications.

Fracture of the upper jaw other than localized fracture of the teeth and alveolar process is undoubtedly rare in children. We have not as yet seen a unilateral fracture of the maxilla with or without mobility or displacement. Such fractures could, however, be successfully treated by the use of arch wiring and orthodontic appliances and by wiring the teeth in occlusion. Fracture of the entire upper jaw with, at times, complete severance and loss may occur. This is usually due to collision with the horizontal wire of a fence in an accident on a sled or toboggan or in skiing. Similar injuries may occur when a horseback rider collides with an unseen wire. Collision with the wire must force back the angles of the mouth parallel, permitting the wire to come in contact with the molar teeth or to slide behind them, and the force, weight and movement of the child's body tears the maxilla from its attachments.

The treatment of displaced fracture of the entire maxilla is similar to that outlined, with the additional necessity of employing an upper jaw splint, with extra-oral arms attached to a head appliance in some cases.[11]

Fracture of the malar bone is also rarely seen in children, though, from time to time, one sees older children with asymmetry of the cheeks suggestive of a previous injury. Should malar bone fracture occur, the depressed displaced bone can usually be pulled and manipulated into position by malar tenaculum forceps or a large towel clamp, if such treatment is not delayed more than a week or ten days.[12]

Fractures of the nasal bones, which are common in children, can be treated by intranasal and external manipulation supplemented, if necessary, by intranasal packing and external splinting.[13]

Hemorrhage and primary or secondary shock may occur in fractures in children, and must be looked for and treated by the accepted methods. Serious infection such as cellulitis, abscess or osteomyelitis may ensue, necessitating adequate surgical drainage and painstaking care. Sulfonamide drugs may be indicated to assist in combating the infection.

REPORT OF CASES

CASE 1.—A girl, aged 17 months, fell down the basement stairs striking her chin upon the cement floor. She sustained a deep lacerated wound beneath the chin on the left side, and there was bleeding from the mouth. Examination

revealed a fracture of the mandible between the left lateral incisor and cuspid teeth and some displacement of the teeth and fragment, with, however, but slight mobility on firm manipulation. There was no displacement of the lower border of the jaw, and it was believed that the periosteum was not torn. A roentgenogram (Fig. 4) confirmed the clinical findings.

Under ether anesthesia, the alinement of the teeth and alveolar process was corrected by manipulation, an operating room cap was cut and adjusted to fit the child's head and an ace bandage was applied. The ace bandage and the headcap were reinforced with narrow strips of adhesive tape. The chin wound healed normally and union progressed without complication with the steadying of the mandible in occlusion by bandaging. A liquid diet was given for three weeks and a soft diet was used for an additional month.

CASE 2.—A boy, aged 19 months, was knocked down by a car, which backed over his head. There was extensive bruising and crushing of the facial tissues, and the mandible was fractured through the right cuspid region. (Fig. 5, A.) One week after the accident, the patient was well enough to be brought from his home (Montana) to Minneapolis for treatment. Examination showed that the right deciduous cuspid tooth was missing and there was marked displacement of the fragments. The posterior fragment was displaced upward and externally to override the left fragment, which was displaced slightly backward and toward the right. There was marked swelling of the facial, intra-oral and gingival tissues and suppuration in the line of fracture. On the right fragment, there was but one erupted tooth, the first deciduous molar. The swelling of the gum tissues about the teeth was obviously too great to secure a good impression and would have prevented satisfactory application of a splint. Under light ether anesthesia, the fragments were reduced and loop wires were placed on the anterior teeth of the mandible and maxilla. Single loops were placed on the deciduous molars. There were but five erupted teeth in the upper jaw. Four tie wires were used; but the loop units loosened from the deciduous incisors and displacement recurred. Overlapping loop units (Figs. 5, B and C) were then applied with both vertical and diagonal tie wires as well as horizontal direct dental wiring across the line of fracture. This was supplemented by carefully applied ace bandaging to hold and support the mandible in order to reduce the strain imposed upon the relatively insecure wiring. Nasal tube feeding was employed for four weeks. The unusually severe initial trauma, swelling and infection, the lack of a sufficient number of teeth for satisfactory wiring and the age of the patient, all this made necessary an unusual amount of care with a number of adjustments and replacement of wiring and readjustment of the headcap and chin bandaging. Slight infection of the line of fracture persisted, and four weeks after the institution of wiring, the tie wires and the wires on the upper teeth were removed. Examination showed that there was still slight mobility of the fracture without, however, any tendency to displacement. The direct dental fixation wire from the molar on the distal fragment to the incisor teeth was reinforced and the headcap-chin bandage was continued. The wires were removed from the lower teeth forty-eight days after the initial reduction of the fracture, and union was found to be progressing favorably. There was, however, a slight spring at the site of fracture, demonstrated by strong manipulation. The occlusion of the teeth was not quite nor-

mal, but it was believed that this would become readjusted in time, with aid if necessary at the age of 5 or 6 years through orthodontic treatment.

Eighteen months later, the child returned with an enlargement of the bone, and a small sinus present in the region of the fracture. This was due to a dentigerous cyst that had developed about the crown of the permanent cuspid tooth involved in and injured by the fracture. The cyst and deformed tooth crown were removed, and the postoperative course was uncomplicated.

CASE 3.—A boy, age 3½ years, succeeded in starting his grandmother's car and drove it for a short distance before colliding with a tree. He struck his chin against the steering wheel and sustained a fracture of the neck of the right condyle of the mandible. (Fig. 6.) The body of the mandible was displaced backward and to the right.

Under ether anesthesia, loop wires were applied; the displacement was corrected, and the teeth were wired into occlusion.

The wires were adjusted several times and were removed in twenty-two days. After the mouth was permitted to open, the displacement to the right did not recur.

CASE 4.—A girl, aged 7 years, fell from a hayloft and struck her chin on a projecting nail on her way down, extensive laceration with severe hemorrhage and a compound comminuted fracture of the mandible resulting. The bleeding was controlled; several detached fragments of bone were removed, and the wound was thoroughly cleansed and sutured. The patient was admitted to the hospital in Minneapolis on the sixth day. Examination revealed a fracture of the left cuspid-bicuspid region of the mandible with marked mobility, but without overriding displacement or much disturbance of the occlusion of the teeth.

Under ether anesthesia, external arch bars were wired to the upper and lower teeth, which, on the lower teeth, constituted direct fixation of the fracture.

The teeth were held in correct occlusion by tie wires from the lower to the upper arch bars for seven weeks, a somewhat longer period than usual on account of the initial comminution and loss of bone.

During this period, there persisted an external sinus leading to bare bone at the site of fracture, as well as two intra-oral sinuses to unerupted teeth in the fracture line. Union was found to be progressing, although manipulation demonstrated very slight movement. The patient was permitted to open and close the mouth during the day. The arch bar on the lower teeth continued to act as a support. At night, the bars were tied together with linen thread to secure the teeth in occlusion and give rest to the mandible. The wires and bars were removed at three months, and bony union was by this time quite strong. One month later, a sequestrum was removed through the external sinus, and a displaced deciduous molar tooth was removed from the region of the fracture. Small sequestra extruded from the alveolar process sinus about the fifth month. Sinuses persisted without any discomfort or appreciable amount of suppuration, and conservative treatment was followed to give the permanent teeth every opportunity to develop and erupt. Finally, it was determined that the development of the first molar roots had been stopped by the fracture, and that in-

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fected granulation tissue had developed in the region. The removal of the tooth and infected tissue was followed by complete healing of the area.

CASE 5.—A girl, aged 9 years, riding in a car, sustained a bilateral compound fracture of the mandible between the first molar and the unerupted second molar of the left side and in the cuspid-bicuspid region on the right side. (Fig. 7, A.) Displacement of the central fragment was marked and there were extensive facial lacerations. The patient was brought to Minneapolis on the fifth day. By good fortune, her dentist had made casts of her teeth two weeks before the accident. These proved of great service in the preoperative study of the displacement and in adaptation of an external arch bar splint. Under ether anesthesia, loop units were applied to the teeth on the upper and lower jaw, and an external arch wire was secured to the lower teeth to afford direct fixation for the fracture in the cuspid-bicuspid region on the right side. The planes of the fracture line favored lingual displacement of the lower border of the central fragment, and it was found necessary to drill holes through the lower border of the jaw adjacent to the fracture lines and to secure the fragments with silver wire. A Penrose drain was inserted to the wire and the teeth were wired in occlusion. Two weeks later, the loop units slipped off the upper anterior teeth, which were not completely erupted. Cast labial caps with loops (Fig. 3) were cemented to the upper incisors, and tie wires were again applied to secure the teeth in occlusion. One month after the accident, a fragment of bone was removed from the right side of the fracture. Six weeks after the injury, because swelling and infection had increased on the left side, an abscess was incised and a deciduous molar interfering with drainage was extracted. The teeth were again wired to occlusion. The wiring and arch bar splint were removed in two months, when it was found that the fracture in the right bicuspid region was uniting satisfactorily. The fracture in the left molar region showed moderate mobility, without, however, a tendency for displacement. Bandage support was used, and the patient was kept on a liberal, but very soft diet. Further localized abscess formation and separation of fragments or sequestra occurred during the next two months, before union on the left side finally became complete.

CASE 6.—A girl, aged 7 years, was struck by a car, sustaining a fracture of the humerus and a compound fracture of the mandible between the right first molar and the second deciduous premolar. Considerable difficulty was encountered in reducing and securing the fracture of the humerus, and there was a delay of three weeks before the patient was brought to Minneapolis for treatment of the fracture of the jaw. Examination revealed a distal displacement of the larger anterior fragment, with a complete override and external and forward displacement of the posterior fragment containing the first molar tooth. (Fig. 8, A.) Union had progressed in malposition to the extent that but a slight spring was found on strong manipulation. Impressions were taken of the teeth, from which casts were made. The cast of the lower teeth was divided, reassembled and articulated with the upper cast. A vulcanite splint was made to fit the reassembled cast with articulating facets to engage the upper teeth for use in the conventional manner or combined with circumferential extraperiosteal wiring if found necessary. Under ether anesthesia, the malunited

fracture line was cut through, and the fractured surfaces were roughened and cleared of fibrous tissue. The first molar on the posterior fragment was found to be firm, with a well-formed crown suitable for wiring. The fulcrum method of external arch wiring (Figs. 8, C and D) was then used instead of the splint that had been constructed. This fulcrum wiring secured the posterior fragment to the anterior fragment and prevented any recurrence of displacement of the posterior fragment buccally. The twisted arch wire was secured to the anterior teeth and to the teeth on the left side of the mandible. Loop units were applied to the upper teeth and tie wires were used to secure the teeth in normal occlusion. There were no postoperative complications. The tie wires were removed in forty-five days and the fulcrum direct fixation arch wires were removed in sixty-six days. Union was complete and the occlusion was normal.

CASE 7.—A girl, aged 6 years, was struck by a car with locked wheels and was pushed for a considerable distance on the pavement, sustaining a bilateral compound fracture of the mandible and fractures of the clavicle, scapula, radius, ulna and pubis, as well as numerous contusions and friction burns. The symphysis of the mandible (the central fragment) was driven posteriorly about 1 inch and downward about half an inch. (Fig. 9, B.) Separate impressions were taken of the teeth on each lateral fragment. These were reassembled and articulated with a cast made from an impression of the upper teeth. A vulcanite splint was made to fit the teeth on the reassembled cast, with facets to fit the occlusal surfaces of the upper teeth. The patient was then anesthetized with ether, and the displaced fragment was brought forward into its normal position, where it was secured into the splint by circumferential wiring, the technic of which has already been described. (Fig. 10.)

The tissues of the chin, including the periosteum, were found to be separated from the labial surface of the bone down to its lower border, and the wire was placed around the central fragment without the necessity of a submandibular skin incision. The wires around the lateral portions of the mandible were placed in the region of the second deciduous premolars. The bony fragments were brought into correct alinement, and the wires were tightened over the splint. Risdon external arch wiring was applied to the upper teeth, and the splint and lower jaw were wired to occlusion. (Fig. 9, C.) The postoperative course was uncomplicated. Five weeks later, the circumferential wires were untwisted and the splint was removed. Union of the fracture in the right cuspid region was found to be firm, but the fracture on the left showed considerable mobility. An arch wire was then fitted and wired to the teeth of the lower jaw, and the ends of the untwisted circumferential wires were shortened and twisted over the arch bar. The teeth were then secured in normal occlusion with the upper teeth by tie wires. The tie wires were divided at the tenth week and union was found to be sufficiently secure for the removal of the circumferential wires and arch bar. The separated labial periosteum had become reattached to the symphysis and the swelling had subsided. Six months after the injury, a swelling developed beneath the chin with abscess formation necessitating incision. A small sequestrum was found and removed. Healing was uneventful.

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SUMMARY

Fractures of the lower jaw in children, which are by no means infrequent, may present unusual problems to be met in reducing complicated displacement and maintaining the fragments in correct position. Methods of treatment used effectively in adults are applicable to most cases of fracture in children. Painstaking supervision and care are necessary in order to overcome the difficulties incidental to the utilization of deciduous, partially erupted or insecure teeth for the direct fixation of the fracture or for the wiring of the teeth in occlusion. Patient and kind handling of these injured children will usually assure cooperation and an altogether satisfactory union of the fractures.

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CORRELATED FIXATION OF MANDIBULAR FRACTURES

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THE conservation of manpower is a very important function of both the civilian and the military service hospital staffs. Fractures and their sequelae tend to deplete such manpower because of the usually long period of hospitalization. It is therefore necessary that every available means be utilized to reduce and fix these fractures so that the patient can continue his duties without interference. This further implies that the splint must be on the fractured jaw only and that it shall not impair masticatory function. The procedure which has proved successful in average hands is described below.

The treatment proposed can be used only when there are a sufficient number of teeth on both sides of the fracture lines. When there are an insufficient number of teeth or the jaws are edentulous, the accepted methods of pin-fixation (Roger Anderson appliance, Hayes-Griffin appliance and others), splint and circumferential wiring and external elastic-fixation to headcast in conjunction with wired dentures are all useful and satisfactory.

Most of the mandibular fractures seen in the service are compounded and the fragments dislocated. Many are also comminuted. This condition necessitates reduction before fixation, and the use of multiple loop intramaxillary wiring[1] and intermaxillary elastic traction is to be strongly recommended. By this method, reduction is complete in from six to twelve hours and organization about the coapted fracture ends begins in several days. At the end of three weeks, in the average case, it has been found feasible to replace the wiring with a mandibular acrylic splint and discharge the patient to duty and the outpatient service. Thus, the average fracture case, requiring about seven weeks of hospitalization, now requires only twenty-one to twenty-five days.

INITIAL CARE OF PATIENT

The average time after injury that the patient reports for treatment is approximately six hours, the range being from one and a half hours to three days. The patient is carefully examined by the surgical officer for possible complications and by the dental officer to determine the extent of maxillofacial injury. In extensive dislocation and laceration, the surgical officer cleans the face and places a primary suture after implantation of a sulfonamide and rubber dams or band drains. The dental officer places a sus-

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pensory type bandage about the head and jaws and sends the patient for routine roentgenographic study of right, left and postero-anterior views of the maxillofacial region.

After clinical and roentgenographic study of the case, treatment is planned. The first concern after control of hemorrhage and reduction is maintenance of an adequate air passageway. If, owing to extensive laceration of the pharyngeal tissues, there is any doubt as to the adequacy of the airway, the jaws should not be brought into occlusion, but a 14 or 16 gage half round wire bar should be adapted around the buccal surface from the last tooth on one side to the last tooth on the other, and the teeth ligatured to it. This will permit care of the throat tissues and introduction of a metal airway if necessary.

If there is no damage to the throat tissues, the intermaxillary loops on each jaw can be brought together with elastic intermaxillary traction bands. The elastic bands should be directed so as to reduce displacement.

Supportive treatment consists of (1) administration of a sedative (pentobarbital sodium 1½ to 3 grains and acetyl salicylic acid 5 grains have proved very satisfactory); (2) a liquid diet, consisting of fruit juices, milk gruels and purees and containing a minimum of 1,800 calories, and (3) administration of sulfadiazine 1 gm. every four hours, as a prophylactic measure, accompanied by a fluid intake of 2,500-3,000 cc. for the first three days or until a blood concentration of from 8 to 10 mg. per hundred cubic centimeters is reached. The drug is then reduced to four doses a day for maintenance of the blood concentration for from seven to ten days. If the patient responds well, showing gradual improvement, the drug can be discontinued entirely. During the period of administration, a urinalysis should be made every other day. At the first indication of blood in the urine, the drug should be discontinued. However, this condition can usually be avoided by a sufficient fluid intake. Potassium permanganate (1:2,000) solution serves admirably as a deodorant and antiseptic mouth wash.

INTERMEDIATE CARE OF THE PATIENT

After three weeks of fixation, during which all inflammatory signs should have disappeared and an adequate callus should have formed in the lines of the fracture, acrylic splints may be constructed. Removing the elastics entirely or just leaving two loosely on each side will permit the patient to practice opening the mouth. After several hours, the mouth usually can be opened sufficiently to introduce an impression tray. Impressions are best taken in hydrocolloid and should cover at least one-fourth to three-eighths inch of the alveolar structure in addition to the teeth present. If a water-cooled tray cannot be introduced into the mouh, a flat metal tray may be built up with compound and the added hydrocolloid impression material cooled by a cold water syringe.

The intermaxillary elastics are replaced until the acrylic splint is ready for insertion. When inserted, the splint is fastened down firmly. At this time, any areas of excessive compression of the soft tissues, as evidenced by blanching, will be seen through the clear acrylic. These areas are readily relieved. The occlusion is also corrected to prevent interference in the normal articulation of the teeth.

Two or three days later, the patient is discharged to duty from the hospital to the outpatient department after all adjustments for comfort have been made. He is now required to report every five days for inspection and removal of débris, so that the tissue may remain in a state of health. After five or six visits, a check roentgenogram is taken for the record. The

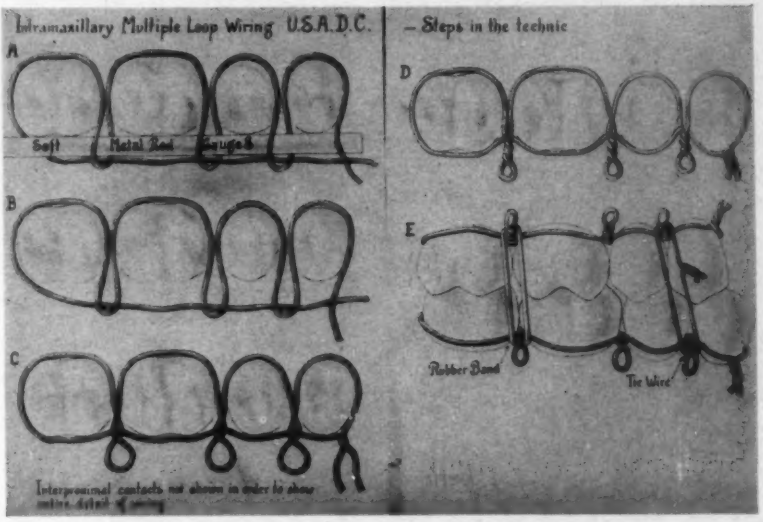

Fig. 1.—Intramaxillary multiple loop wiring (technic [DC], U. S. Army).

splint is permanently removed and the patient warned to avoid trauma to the area for the next six months.

PROCEDURES

1. *Intramaxillary Multiple Loop Wiring.*[1]—This will require a wire about 9 inches in length sufficient to engage the four teeth [from the maxillary first molar to the canine], form three loops, and the necessary length for twisting the two ends together. If more teeth are to be included, a longer wire will be necessary. (Fig. 1.)

1. Quoted from STOUT, R. A. (Colonel [DC]); in Lectures on Military Dentistry. Chicago: American Dental Association.

The wire is first threaded through the interproximal space between the first and second molars, from the lingual aspect. Pull the wire through buccally and forward, along the buccal surface of the teeth as far forward as the lateral incisor, allowing sufficient length for the final twisting of the ends at the mesiofacial angle of the canine. The long lingual end is threaded through the interproximal space mesial to the first molar, passing gingivally to the wire lying along the buccal surface of the teeth. Bend the long end back on itself, threading it below the buccal wire, through the same interproximal space forming a loop. At this point a lead wire, gauge 8, and about 2 inches long, is inserted in the loop and held parallel with the buccal wire and in contact with the buccal aspect of the teeth. The lingual wire is now pulled tightly, giving the

Fig. 2.—Clear acrylic mandibular splint (U.S.D.C.).

loop its proper form and size in correct relation to the buccal wire and the teeth. The lingual wire is then threaded through the next interproximal space (between the bicuspids), passing above the buccal wire and the lead wire, bent around the lead wire and threaded below the buccal wire back through the interproximal space and drawn up tightly once again, thus forming the second loop. In the same manner the next loop is made between the first bicuspid and the canine and the lingual, and drawn tightly so that the lead wire is held rigidly against the buccal surface of the teeth. The lingual wire is now threaded through the interproximal space between the canine and lateral and drawn up tightly. Pull forward (mesially) on the buccal wire with the same

tension as on the other end. This will draw the loops all up into their proper position and give them the desired uniform size. The lead wire is now removed, rotating slightly and moving forward. This is easily done by grasping the anterior end with pliers or the fingers. The ends are again grasped with the pliers and twisted a few times so as to stabilize the wire and to bring the twisted portion to rest on the mesiofacial angle of the canine. Starting with the posterior loop, grasp with smooth beak pliers and twist ¾ turn which will place the loop in a horizontal position, bringing the buccal wire slightly into the embrasure. Proceed in the same manner with the other loops. This adapts the wire well around each tooth. Start again with the twisted ends and give them the final adjustment, twisting until it fits the mesiofacial angle snugly. Cut off the excess twisted ends and neatly adapt against the mesial aspect of the tooth and into the embrasure. (End of quotation.)

2. *Suspensory Type Bandage.*—This type of bandaging has proved very satisfactory for brief or extended use in stabilizing and supporting the jaws. It has the advantage over the Barton, Gibson and Parker bandages in that slipping does not occur and there is simplicity of application. The only cause for replacement in even average hands is dirtiness of the gauze from use.

A 2-inch gauze bandage is applied in the form of a figure 8, beginning at the occiput, coming diagonally forward and downward in front of the ear, under the chin, up the opposite side in front of the ear, across the vertex and down under the occiput. Here, the fingers of the left hand grasp the end and top of the figure 8 each time the bandage is wound around. The bandage is placed firmly and tightly. Two 15 to 20 inch strips are cut and passed through the occipital loop and the vertical chin sling at the level of the inferior border of the mandible of both sides. When these are tightened and tied, the bandage is firmly anchored. To take up the slack of the stretched gauze after a few days' use, adhesive strips may be placed crosswise on the vertical sling at the level of the eye and also at the level of the anchor tie piece, and safety pins inserted. Elastic bands can be placed over these, and thus a constant upward pull be obtained.

3. *Liquid Diet Administration.*—A liquid diet should be given in three hour feedings from 6 a.m. to 9 p.m. Cup and bowl feedings are very satisfactory when there is continuity of the buccal orifice. Destruction or paralysis of the lips requires spoon feeding or the use of oropharyngeal feeding. Rectal feeding can be resorted to in cases of complete dysphagia.

4. *Acrylic Splints.*—These are made of clear acrylic. (Fig. 2.) It is best that the original model be duplicated and the duplicate used in the fabrication of the splint. The model is waxed up sufficiently high on the teeth to grasp them firmly and yet not interfere with the occlusion. The wax is extended over the gingiva about 4 mm. so that the completed splint will be sufficiently strong and extend into the mucobuccal fold self-cleansing areas.

The basic sectional splint consists essentially of one lingual segment and two

buccal sections. (Fig. 2.) The buccal sections are in reality one segment which is split at the median line, thus making two sections. The two buccal sections are connected to the lingual segment distally to the last tooth included in the splint on either side by a piece of 14 gauge half round clasp wire. Orthodontia band material may be used in lieu of this, but clasp wire is preferable and more likely to be available. An undercut button about one-quarter inch in diameter is built into the buccal portion of the splint at the median line. The cut which divides the buccal portion into two sections is made vertically through this button. When the splint is placed in position in the mouth, a brass ligature wire is passed around the two halves of this button and when tightened pulls the buccal sections firmly about the teeth and secures the appliance in the mouth. For retention and stability the splint depends on its grip on the bell portion of the crowns of the teeth.[1]

Modern Methods in Anesthesia and the War.—Lack of experience of a situation sometimes leads to ill founded conclusions. It is probable that neither the care of accidents in civil practice nor the performance of necessary surgical procedures for soldiers and sailors in time of peace has constituted an adequate background of experience from which to predetermine our conduct under the circumstances of war. Doubtless both surgeon and anesthetist will modify their plans of action as experience with battle casualties becomes extensive in the months and years to come. It would seem advisable, therefore, to emphasize principles rather than minutiae of practice in our preparation for the duties which confront us.

There is a variety of anesthetic agents available for the relief of pain. Several techniques have been used in civil practice. On superficial consideration, it might be concluded in the interest of simplicity that one or two drugs given by one or two techniques should be chosen for military practice. However, further reflection brings out many objections to such a conclusion. For instance, it may be assumed that the variety and gravity of disturbances of the physiological functions of the respiratory and circulatory systems which are encountered among the wounded will be as great as, if not greater than, the variety of such disturbances common in civil practice. Hence, the demand for a varied attack by the military anesthetist may be even greater than in civil practice.—*Surg. Gynec. & Obst.*, 76:125, January 1943.

PLASTICS AS A SUBSTITUTE FOR METALS IN FRACTURE APPLIANCES

JOSEPH FREEMAN,* Tuxedo, Manitoba

IT is essential that dental surgeons undertaking the care of complicated and multiple fractures of the facial bones shall have on hand a number of appliances that may be utilized or modified to meet the special situation. This provision gives the surgeon added confidence, saves a great deal of time and permits the reduction of fractures at an earlier period. It is of particular importance in many of the displaced and semi-impacted fractures of the maxilla.

For the reduction and stabilization of fractures of the upper jaw, many types of appliances have been devised, probably originating with plaster headcaps to which were attached straps and metal arms. Head appliances have now been simplified and have been made more of a skeleton type by means of strong adjustable cotton straps sewed to temporal pads and plates. These afford a more stable hold upon the occipital and frontal regions, thus overcoming the tendency of the head appliance to slip forward when considerable force is necessary to elevate and hold the fractured upper jaw. Padded leather head appliances, made adjustable by means of straps, metal connections or lacings, have been described in the past few years. [1, 2]

Many of the newer head appliances described in the literature have utilized more or less universal joints that function in the correction of displacements and in the fixation of the fragment when reduction has been accomplished. These universal joints have made possible the movement of a fragment in any direction, and when these joints are tightened, the jaw is held securely against displacement in any direction and is not suspended or pulled into position by means of straps or wires. It is not the purpose of this communication to analyze the various methods of treatment, but merely to present the details of construction of headcaps, splints and appliances that are simple and inexpensive and can be made without too much expenditure of time.

The present war, bringing about an extreme shortage of metals on the open market, with the difficulties of priorities, has made necessary the utilization of other materials serving the same purpose. In the construction of the universal headcap and the universal joint, I have replaced most of the metals by a plastic material called Perspex.† The source of this plastic lies in the salvage of obsolete and cracked-up aircraft, the material having been used for windows.

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*Captain, Canadian Dental Corps (R.C.A.F.).

†A similar material used in the United States is known as Plexiglas.

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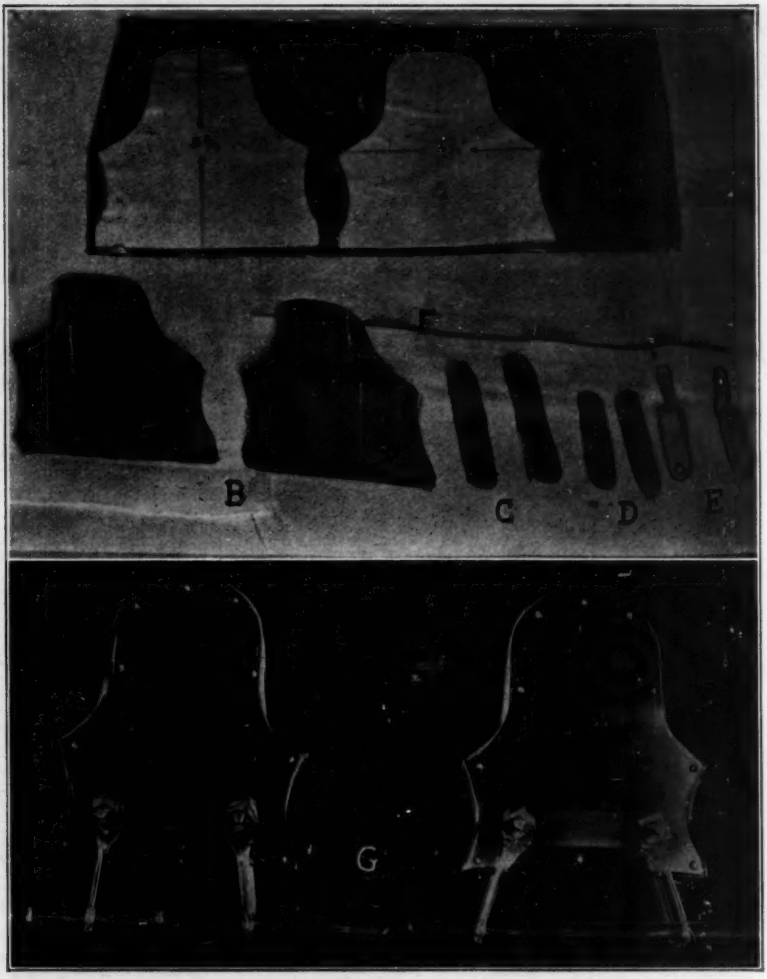

Fig. 1.—A, pattern of temporal plate 3½ by 3¾ inches on paper glued to sheet of Perspex. B, temporal plates cut and polished, and holes drilled. These are cut by means of an ordinary circular plaster hand saw, trimmed with sandpaper on a chuck and polished with wet pumice and rag wheels. C, cross-bars; Perspex, one-quarter inch thick, ½ by 2 inches, for additional strength and stabilization; holes drilled one-quarter inch in diameter. D, arms connecting horizontal temporal rods with temporal plates ½ by 1¾ inches of one-eighth inch Perspex; holes drilled one-quarter inch in diameter. E, arms bent to extend outward and turn the lower portion at right angles. The end of each arm is dipped in boiling water and twisted, one arm to the left and the other to the right to give extra length on the temporal rod, between the arms. The angle of photography and the bend make these arms appear longer than in D, but actually they are of the same length. G, temporal plates assembled. The rods are clear processed dental acrylic seven-thirty-seconds inch in diameter. It was found that there is a slight spring to these rods, which can be overcome by placing a fine steel rod in the middle and processing the acrylic around it. The rods should fit tightly in the arms and can be fused to them by a drop or two of acetone, to prevent rotation of the rod.

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CONSTRUCTION OF THE UNIVERSAL HEADCAP

The specifications of the headcap used by Waldron and Balkin[3] were followed, substituting Perspex for the brass parts of the headcap assembly. (Fig. 1.) It can be similarly used in the construction of many other types of headcaps that have been described in the literature.

The temporal plates are sewn on temporal pads of sponge rubber, which, in turn, are joined by adjustable cotton twill bands across the forehead

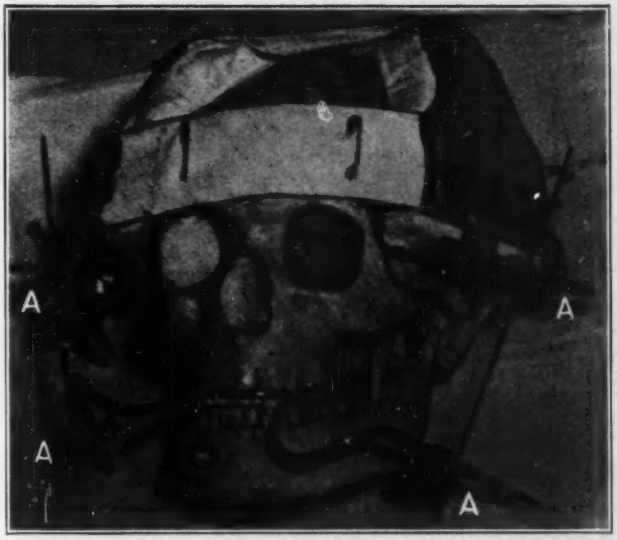

Fig. 2.—Universal headcap completely assembled. Steel horizontal extra-oral arms slip into rectangular tubing on a universal dental splint. The arms extend forward between the lips and then outward and backward. They are attached to the temporal plate on the headcap by means of vertical rods and universal joints (A), which permit adjustment of the displacement in all directions and planes and, when tightened, are secure.

over the vertex and below the occipital protuberance, to complete the assembly. (Fig. 2.)

Perspex can be used for the construction of the frontal plate head appliances used in Kirschner wire transfixation of the mandible or maxilla and complicated fractures of the nose, and for oblique traction in certain fractures of the mandible. (Figs. 4 and 5.)

CONSTRUCTION OF A UNIVERSAL JOINT

The original universal joint is a standard tool appliance made by the Starrett Tool Co., Athol, Mass., the upper unit of No. 56 surface gage. The

Fig. 3.—Above: Steps in construction of plastic portion of universal joint. From left to right, various stages in construction of universal joint. The first two figures show two layers of Perspex of one-quarter inch thickness united to give the necessary bulk. This material is united by dipping one surface of each part in acetone until it becomes tacky. The surfaces are placed together and held in position in a vice for half an hour. The union is perfect if the surfaces are flat. The material is then cut into squares of the desired length and width and one one-thirty-second inch hole is drilled at right angles to the line of union. The material is now trimmed around this hole. Another hole with a countersink is then drilled at right angles to the first hole. The block is now trimmed by means of sandpaper on a chuck to the necessary length and width. The block is split at right angles to the countersink by means of a carborundum disk on a mandrel and the inner surfaces of the split are polished by means of sandpaper disks. It is now polished smooth by means of wet pumice and rag wheels. Center: One-eighth inch set screw, sleeve and thumb nut. These can be made in any machine shop. Right, assembled universal joint affording adjustment in three planes. Below: Ordinary wood drill seven-thirty-seconds inch in diameter made into a countersink drill. The narrow portion of the drill is one-eighth inch in diameter. Right, all-metal universal joint, upper unit of No. 56 surface gage.

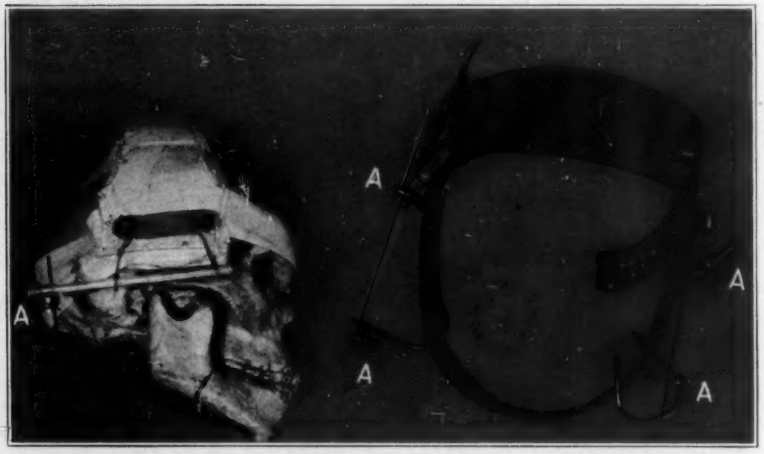

Fig. 4.—Left: Universal headcap with posterior vertical rod made adjustable by universal joint (A) in Darcissac's method of controlling posterior fragment. Right: Plastic headcap without padding or bands, showing adjustable plastic submandibular support, horizontal arms, vertical rods and universal joints (A) assembly.

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use of Perspex for one part of the universal joint simplifies its construction and obviates use of a special die for machining the part. These universal joints can also be used in various skeletal fixation appliances, and appliances used in the reduction of fractures of the nose and fractures of the

Fig. 5.—Plastic frontal head appliances. Left: Diagonal rubber band traction from arm extending from cast mandibular splint to vertical rod attached to headcap by means of universal joint. Right: Forward and upward rubber band traction from Kirschner wire transfixing symphysis in bilateral fractures of condyles with posterior displacement of jaw.

malar-zygomatic compound. It can also be used in the modified Darcissac's method of securing a posterior fragment.

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No. 2 Training Center.

TIE-LOOP WIRING IN THE TREATMENT OF JAW FRACTURES

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FOR the past two years, I have used an intra-oral wire unit that may be described as a tie-loop unit. This device has proved to be of great value in treating fractured jaws.

This wire unit can be used singly or in conjunction with other types of fracture wiring and appliances. Present-day standard wiring methods and units are usually quite adequate and practical. However, this tie-loop has made possible secure fixation in many cases in which the usual methods are not satisfactory.

As the term implies, it is essentially a wire loop which is made by tying a simple knot in a wire. (Fig. 1, A.) It may be used as a single or multiple loop unit or otherwise modified in several ways. It can be applied to any accessible surface of a tooth, or it can be used between teeth in similar fashion as the standard twisted wire loop. (Fig. 3.) If wire of 24 or 25 gage, or thicker wire, is used, there is sufficient strength to prevent collapsing or stretching of the loop provided it is properly locked. If 26 gage or finer wire is used, it is necessary to use solder at the tie, for added strength, to prevent the tie loop closing when the ends of the wire are twisted on the tooth. (Fig. 1, B.)

Practical application of the tie-loop unit is simplified and made more efficient if attention is given to the details of tying the loop for its specific purpose. No special attention is necessary when it is to be used as an accessory loop on the distal tooth of a modified Risdon twisted wire arch, on a fulcrum type wire arch or as individual lingual loop units. (Fig. 2, B.)

If individual tie-loop units are to be locked, it is essential that a decision be made as to whether the locking twist in the wire is to be at the mesial or distal portion of the tooth, upper or lower, to which the unit will be attached. To make the locked tie-loop, a wire tie loop is formed and held in the same relative upward or downward position as it will be when placed on the tooth. If the final locking twist of the wire is to be made mesially from the loop, a simple tie knot is made in such a way that the wire extending mesially shall pass under the wire extending in the distal or opposite direction when the knot is formed. The distal wire is then passed around the tooth and through the tie-loop from beneath it on the mesial aspect. By pulling this wire tightly and bending it mesially, a very secure circumferential hold on the tooth is obtained. It is then twisted with the mesial wire to complete the locked twist unit. (Fig. 1, C.) If the locking twist is planned to be posteriorly from the tie-loop, the knot is reversed, the distal extending wire passing under the wire extending in the mesial direction. Then one wire is

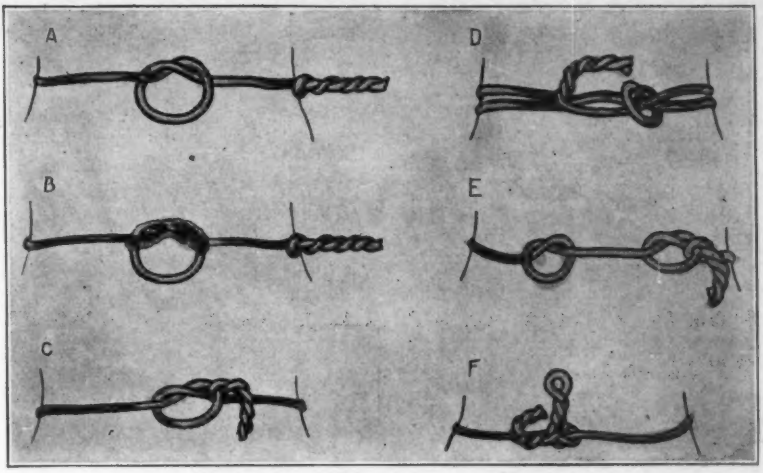

Fig. 1.—A, plain tie-loop twist. This will not withstand a hard pull owing to the untwisting of the wire under tension when used as a single unit; but if used as a necessary loop at the start or anywhere along a Risdon arch (plain, modified or fulcrum types), it is a strong attachment loop. B, same wire loop soldered. C, method of locking tie-loop. It will not open and will stretch very little. D, tie-loop with double circumferential wire, which offers more resistance to stretching or loosening owing to frictional resistance from wire. E, multiple loops, which are often valuable. F, twisted post or spur over tie-loop, which is also locked and which makes an excellent unit for use of rubber band immobilization or traction for emergency treatment when transportation or evacuation problems are involved. This unit is constructed by first making the twisted post, which may be stiffened by solder, then tying the simple knot and proceeding to apply and lock it into the tooth as the regular locked tie-loop.

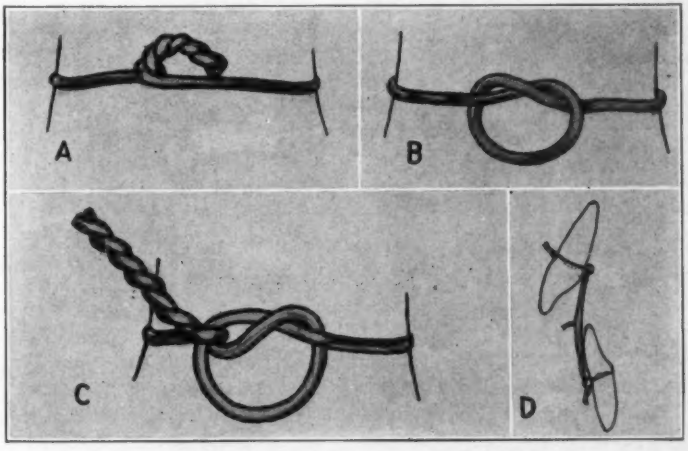

Fig. 2.—Use of tie-loop in cases in which relationship of teeth vary, as in prognathic, retrusive or open bite conditions, or cases in which special traction force requires position of tie-loop to be lingually or otherwise positioned; to correct or control buccally or lingually displaced fragments in anterior or posterior part of mouth. A, labial loop. C, labial locked tie loop. D, use of tie wire to loop on palatal side in cases of open bite or protrusion of maxillary incisors.

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brought around the lingual surface of the tooth, passed through the loop from beneath, pulled tightly on to the tooth, bent over and lock twisted. (Fig. 3.)

The advantages of this type of loop are:

1. It can be used on individual teeth more efficiently than a plain circumferential anchorage wire.

2. It can be placed high up along the gingival aspect of any exposed or accessible surface of a tooth.

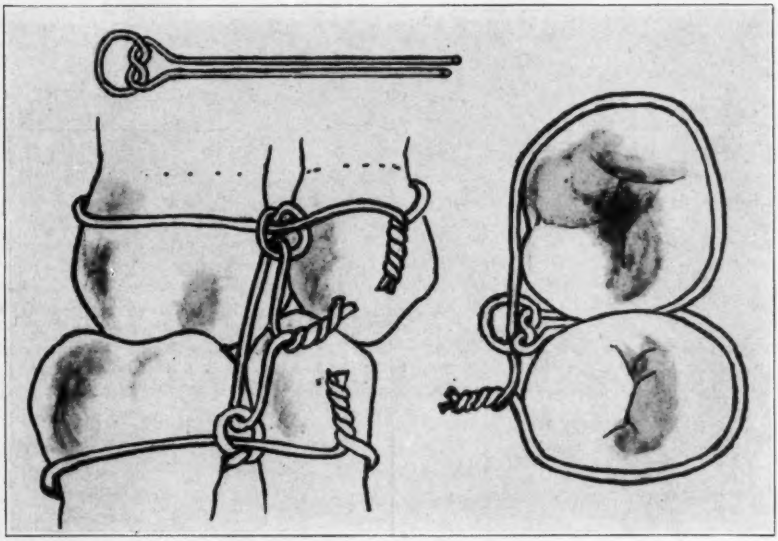

Fig. 3.—Tie-loop as interproximal loop where two contacting teeth are joined. (In order to bring out detail in sketch, wires were not tightly pulled up.) This may be used as a single or overlapping unit or in the initial attachment of the modified Risdon twisted arch.

3. It provides the maximum vertical height for attachment of intermaxillary tie wires, lack of which is sometimes a pertinent factor.

4. It is especially useful in children's fractures where open contacts and lack of vertical heights are unfavorable.

5. It can be used in interproximal spaces where contacts of teeth are especially tight and will not permit the passage of two wires of the twisted loop unit.

I have been using the many modifications of this tie-loop unit extensively for some time in the treatment of most types of jaw fractures in which teeth are present and can be used, and have found it to be practical, strong and

secure. Further tie-loop modifications will no doubt be developed from time to time to increase its usefulness in immobilizing fractures and maintaining the teeth in proper occlusion.

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SURGERY AND SAFETY

Craftsmanship is of little worth, knowledge is of little worth, unless they are allied with surgical judgment. Now surgical judgment is partly based upon intuition, but it goes far beyond it. It is surely based upon experience, which is the interpretation of what others have seen and done and thought and we have been wise enough to profit by. If, as some cynic has said, experience is the name we give our mistakes, it is likewise, if we are receptive, the touchstone by which we interpret life, and sure it is the foundation stone of judgment. Finally, no surgery can be safe unless the surgeon who performs it adds to his other qualities of mind and heart the greatest of them all, the thing that we call the surgical conscience. One need not necessarily operate in order to possess it. It is possessed in fullest measure, I would say, by the men who would like to be surgeons but who are not because they are honest enough to admit to themselves their lack of fitness for the task. It is the quality which makes the surgeon unwilling to operate until he is sure in his own mind that his training is adequate and his skill is sufficient for him to dare to lay hands upon the human body. It is the quality that makes him more than willing, which makes him eager, to accept the guidance of the man who knows more than he does of special diseases and special procedures. It is the quality which makes him call for assistance promptly and freely when he sees himself drifting beyond his depths. It is the quality which stays his hand from unnecessary surgery, which drives his hand to the surgery of desperation, the surgery that sullies his record, as he knows it cannot fail to sully it, but that gives to dying men and women their only chance of salvation. It is the quality that makes him realize the high seriousness of his calling, that makes him earnest in his purposes, honest in his mental processes, steadfast in his endeavors, courageous in the tribulations that are the inevitable lot of the physician who has chosen to be a surgeon. Matters of technique are important, but they need not be emphasized to the surgeon who possesses the qualities I have just named, natural aptitude, knowledge, judgment and the surgical conscience, for if he possesses them, he cannot fail to possess their fruits. Safe surgery is not a matter of chance any more than it is a matter of complex details. It is first and foremost a matter of sound principles, and the responsibility of their application is the responsibility of the individual surgeon. Let him see to it, then, that he is what he should be, that he does what he should do, for upon his shoulders rests the heavy task of making surgery safe.—C. Jeff Miller, in *Am. J. Surg.*, 1931.

USE OF ORDINARY SMALL BRASS HINGE AS LOCKING DEVICE FOR SPLINTS IN MULTIPLE FRACTURE OF MANDIBLE AND MAXILLA

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OCCASIONALLY, it is necessary, or desirable, to employ upper and lower maxillary splints that can be fixed to each other and separated at will. A rather simple method utilizes an ordinary brass hinge, which can be purchased at any hardware store. By soldering or casting the hinge to

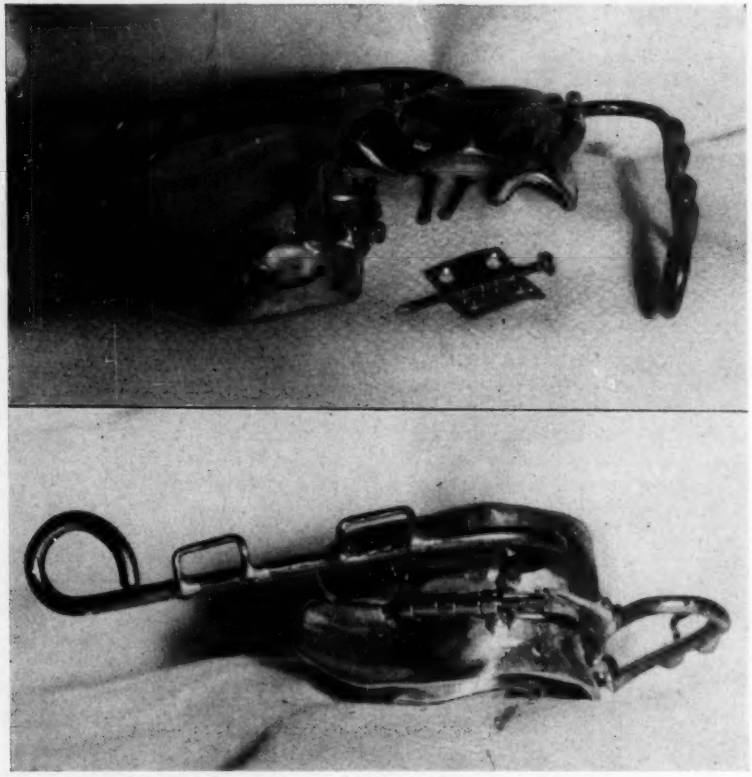

Fig. 1.—Above: Separated upper and lower cast-coin silver splints with halved hinges in place. Also shown is an extra hinge with a nail substituted for the brass post which was a part of the original hinge, and the two nails trimmed to lock the device. On the front of the lower splint can be seen a U-shaped hook, to which was attached a rubber band for anterior traction. Below: Closed and locked splint.

the splints, the upper and lower halves can be united. The bar that holds the hinge together is then driven out and the splints separated or placed

together as needed. Small nails, trimmed for length and of proper diameter, can be inserted in the tubes to hold the device together and lock it there.

The case in which these particular splints were used was one of multiple fracture. There were fractures of both condyles and both coronoids and the symphysis was severely comminuted. The maxilla was transversely separated below the orbits and zygomatic arches, with severe comminution of the ridges anteriorly and in the molar areas. Upper molar teeth had been driven into both maxillary sinuses. There was marked posterior displacement in both jaws. To all intents and purposes, the case could be con-

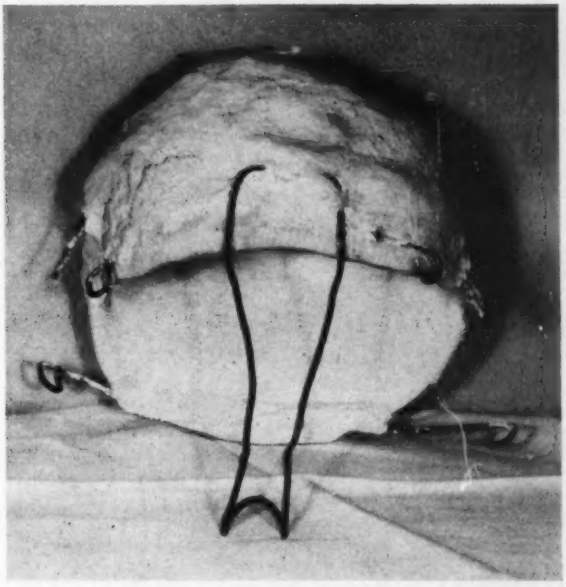

Fig. 2.—Ordinary Scogin headcap, with properly placed coathanger wire, which was used to control actions of splints.

sidered edentulous. Fortunately, the patient had recently been to her dentist for a partial denture, and the models that he had prepared were available for splint construction. The upper half was used as a reverse Kingsley splint; the lower half was retained by two circumferential wires, in spite of the fact that I do not ordinarily consider circumferential wiring a good method for the treatment of fractures. The need here for a forward traction device induced me to use this arrangement. After two weeks, the upper splint was removed and the lower retained for two more weeks, when open reduction of the symphysis was found to be necessary, this need supporting my opinion of the incompetence of circumferential wiring as an immobilizing agent.

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METHOD OF REINFORCING PULPLESS ANTERIOR TEETH

PRELIMINARY REPORT

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ANTERIOR teeth that become pulpless before their root formation is complete are either extracted or, if treated, lack the stability that complete root formation gives. Anterior teeth that are diseased often require root amputation in the course of treatment. As a result of shortening of the root, the stability of the tooth operated upon is diminished; that is, owing to the change in the ratio of the embedded portion of the tooth to the clinical crown.

The use of inert metals in surgery is now well established. The recent investigations of Campbell, Meirowsky and Hyde[1] have shown that ticonium is not cytotoxic either *in vitro* or *in vivo*. Likewise, Key[2] has suggested that the 18-8-S-MO stainless steel wire is suitable, and Pudenz[3] that tantalum wire is the wire of choice.

This passivity was first described by Faraday as due to the protective oxide film. Grave, Adler, Rathert and Schmidt propounded the "hydrogen solution theory of passivity," and Wulff and Uhlig[4] propound the "electron sharing of metal atoms theory."

Wise,[5] in reporting a histologic study of a transcervical fracture after internal fixation of the femur with a Smith-Peterson (vitallium) nail, describes a fibrous tissue membrane lining the nail tract. That there is no evidence of reaction in the surrounding bone coincides with our findings on oral implants.[6]

In view of the toleration of these inert substances, a method has been devised whereby they are used to reinforce the embedded portion of pulpless anterior teeth in the treatment of anterior teeth with incomplete root development due to injury or disease or following root amputation. This consists of passing a rod or wire into the root canal with one end projecting into the space normally occupied by the root apex, the other end being embedded in the usual root-canal filling material within the root canal. Organization and regeneration of bone into the cavity around the projecting end of the rod follow, resulting in increased stability of the tooth.

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†Dental surgeon (in absentia.)
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REPORT OF CASES

The following cases are reported from a series:

CASE 1.—S. B., a boy, aged 10, at the age of 7 was injured while coasting, the left maxillary central incisor being dislodged as a result of a blow. The tooth was pushed back to place, opened into and banded. (Fig. 1, A.) It began to drain and continued to do so for three years. The parents refused to agree to extraction. Dressings were changed bimonthly during the period of drainage.

February 19, 1940, the following procedure was carried out: The band was removed and the root canal cleaned out. (Fig. 1, B.) Figure 1, C shows a probe

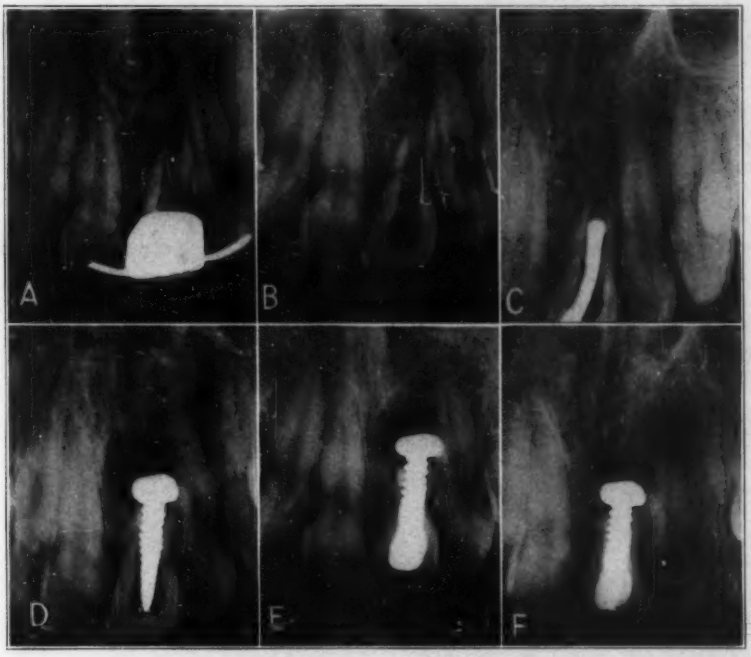

Fig. 1 (Case 1).—Steps in treatment.

in place in the canal. After procaine anesthesia and nitrous oxide analgesia, an incision was made on the buccal alveolar mucosa 1 cm. above the gingival margin of the maxillary left central incisor. A mucoperiosteal flap was turned back and the diseased area normally occupied by the root apex was thoroughly cleaned out. A five-eighths inch Venable (vitallium) screw was passed into the root canal from above downward. (Fig. 1, D.) The root canal was then sealed with chloropercha. Silk sutures were placed on the labial flap. Figure 1, E is an x-ray view taken March 8, 1940. The case has followed an entirely

uneventful course for three years. The diet has remained normal and no conscious favoritism is shown this tooth. Figure 1, F, taken March 30, 1943, shows regeneration around the metallic post.

CASE 2.—B. B., a physician, aged 35, whose maxillary right central incisor (Fig. 2, A) had been unsuccessfully treated, underwent canal reaming and root amputation December 8, 1940 (Fig. 2, B) and a ticonium heavy gage wire post was inserted and sealed up with chloropercha. (Fig. 2, C.) Figure 2, D is an x-ray view taken March 26, 1941. This patient is a member of the U. S. Army in foreign service.

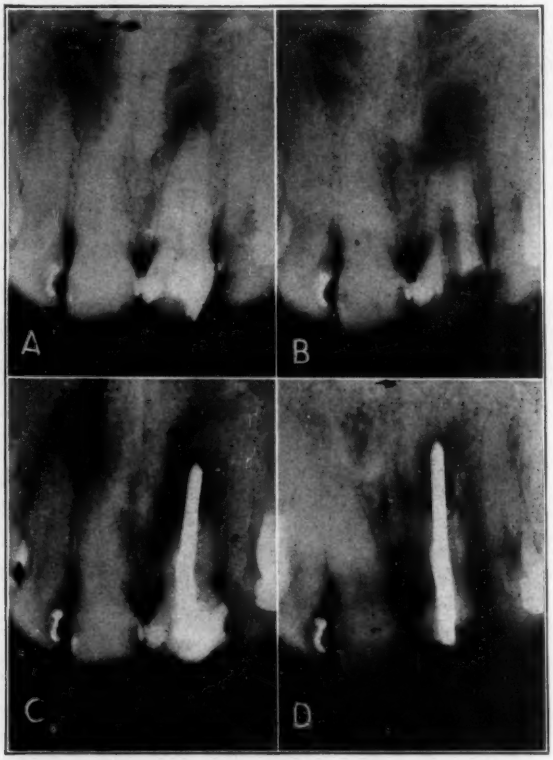

Fig. 2 (Case 2).—Progress in treatment of case.

SUMMARY

In view of the known toleration of certain metals, a preliminary report is made of a method whereby these inert substances are used to reinforce anterior teeth the root development of which is incomplete owing to injury

or disease, and teeth the stability of which is lessened by root amputation. A further report will be made of the entire series when sufficient data have been accumulated.

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Surgical Vision.—No one could for a moment justly disparage the value of experimentation. It has led to innumerable discoveries, to the correction of serious inaccuracies, to the saving of lives. Yet certain types of research have gone up blind alleys for lack of purpose, for lack of a compelling air, for lack of vision. There is wanted as much wisdom to see the irresistible demand for instituting a research problem as there is to conduct the experiments and interpret their findings. The fetish of statistics has done much to confuse the pictures presented in surgical research. A parade of animal experiments, a row of figures and tables, together with elaborate conclusions, may mean a great deal or nothing at all, subject to the character, the environment and the material of the individual investigator, and, further, to proper analysis of reported statistics themselves. May not one intelligent man's conscientious opinion be of parallel value? May not vision be needed as a control factor in experiment? We hug to our bosoms the research worker in surgery who is possessed by an idea, whether it be simply a hypothesis or an actual issue, and who follows it through with unerring faith to the end, but we deprecate the trumping up of a meaningless problem only to exploit a theme which had better remain unsung, or to prove a point which needed no proof. Let us recall the earliest announcement of Hippocrates concerning surgical research: Phenomena first, then judgment, then general propositions, then practical knowledge and craft. If, then, surgical vision derives its impulse from a conception of past, present and future, there is room for its fulfilment in surgical practice. There are three essential ingredients in the make-up of the surgeon—the mental, the moral and the mechanical. The first has to do with knowledge, the second with judgment and the third with skill. In such order, they provide the why, the whether and the how of every surgical question. A well-rounded surgeon recognizes this trinity of attributes and happy indeed is he—and rare in the extreme—who may possess them all in equal degrees. —Hubert A. Royster, in *J.A.M.A.*, 1932.

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MIXED TUMOR OF THE PALATE: REPORT OF CASE

WILLIAM C. WOLFE,* M.D., and HERMAN L. HUBINGER,† D.D.S.,
Hot Springs, Ark.

THOMA[1] describes two main types of oral mixed tumors that may occur on the palate. The one reported here more nearly approximates the central mixed tumor of the salivary gland type.

REPORT OF CASE

History.—A man, white, aged 25, came to a station hospital two weeks after his induction into the Army. The only complaint was a swelling of the palate that gave him considerable difficulty in swallowing and mastication. The mass had been noticeable for the past four or five years. About two years before, the the upper left first and second molars were extracted because it was believed

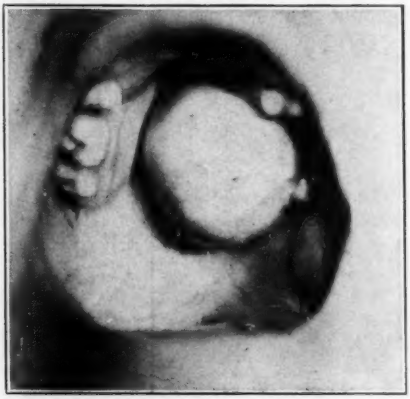

Fig. 1.—Mixed tumor of palate.

that there was an alveolar abscess in the area. However, the mass persisted and continued to enlarge, with increased discomfort to the patient.

Examination.—There was a large protruding cystlike growth covered with normal epithelium on the left posterior aspect of the hard palate, involving the molar portion of the alveolar ridge and the remaining third molar. (Fig. 1.) It was fairly solid in consistency and presented no evidence of being pedunculate or sessile.

Treatment.—Under local anesthesia, an incision was made over the molar

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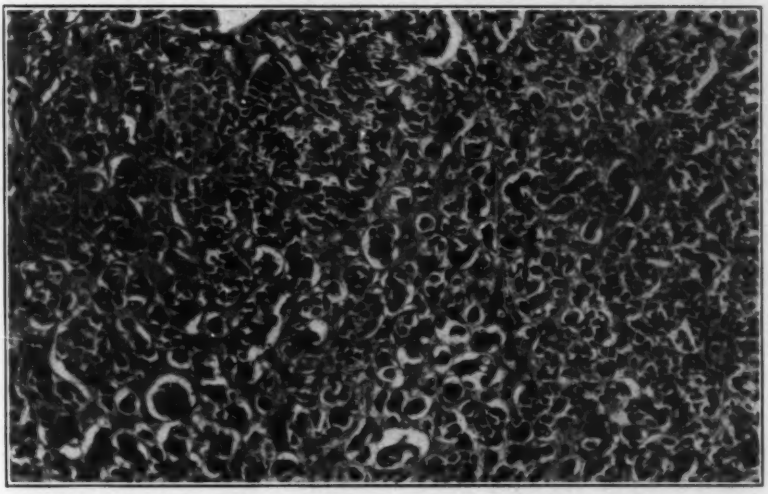

Fig. 2.—Cross-section of tumor, which consisted largely of compact sheets of epithelial cells.

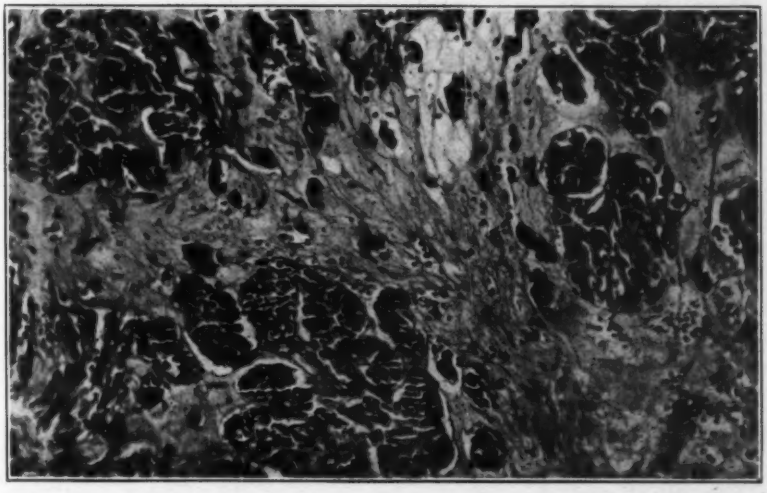

Fig. 3.—Photomicrograph showing myxomatous stroma containing epithelial constituents or islands.

alveolar ridge and along the palatal aspect of the gingivae as far anteriorly as the cuspid tooth. The mucoperiosteum was easily raised from the tumor and the third molar was extracted. The growth was attached to the bone of

the alveolar ridge in the region of the second and third molars. A sufficient amount of bone was removed from the area of attachment to make cautery unnecessary, it was believed. The tumor was then enucleated without difficulty. The palatal bone had been forced into the floor of the nasal cavity, an unbroken and uniform concavity of bone remaining. There were no erosions either of the maxillary sinus or of the nasal cavity. The anterior palatine artery was severed and tied. After the incision had been closed, a compound stent and gauze were used to approximate the mucoperiosteum to the bony concavity. The stent was left in the mouth for twenty-four hours.

Three days after operation, there was evidence of necrosis and sloughing of the mucoperiosteum covering the central portion of the palatal defect. This was followed by uneventful granulation.

Laboratory Report.—Grossly, the mass measured 4 by 2 by 2 cm. It was entirely encapsulated except at the base. Sections through the tumor revealed grayish red lobular tissue having the consistency of lymphoid tissue.

Microscopically, there were masses of epithelial cells arranged for the most part in solid sheets. (Fig. 2.) The cell outlines were indistinct and contained a moderate amount of cytoplasm. The nuclei were oval or round with loosely arranged chromatin. Most of the tumor was comprised of this tissue. The remainder of the tissue consisted of a myxomatous material which contained scattered cells of diverse structure. Some of these cells had basophilic cytoplasm with hyperchromatic nuclei. Others had a spidery appearance with long processes transversing the spaces in which they were lying. Still others were small with little cytoplasm. In a few areas, there was a more homogeneous acidophilic substance containing cells that were sometimes paired as in cartilage. This tissue appeared to represent osteoid tissue.

There were no areas of acini with eosinophilic colloid material.

Diagnosis.—Mixed tumor of the palate was the diagnosis.

Army and Navy General Hospital.

Local Anesthesia.—The scope of local anesthesia in office practice may be made comparatively broad. Its use has advantages that are both economic and psychic. It is of special advantage to the isolated practitioner of medicine who lacks hospital facilities. Its use demands special training and equipment and no one who is not prepared to employ it skilfully should essay its use. With proper training and equipment local anesthesia may be employed in office practice with a great deal of satisfaction to the physician, surgical specialist and their clientele.—R. E. Farr, in *Am. J. Surg.*, 1930.

VERTICAL IMPACTION OF CUSPID IN OTHERWISE EDENTULOUS MOUTH: REPORT OF CASE

H. Newman Brownson, D.D.S., Hollywood, Calif.

History.—Mrs. R. T., aged 35, seen January 13, 1942, complained of tenderness in the anterior region of the mandible on wearing a denture. Eight years before, the patient had all of the lower teeth removed with the exception of an impacted cuspid, which, at that time, she was advised not to disturb owing to possible operative fracture. The condition caused the patient great worry. At the time that the teeth were removed, a denture was made, but, on wearing the appliance, the patient suffered pain and discomfort.

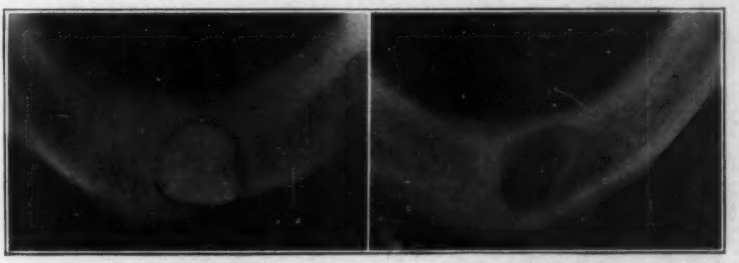

Fig. 1.—Left: Preoperative occlusal film. Right: Postoperative film.

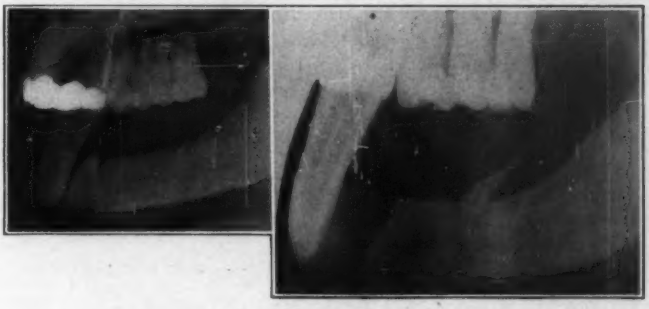

Fig. 2.—Left: Preoperative condition. Right: Postoperative condition.

Examination.—The mandible was edentulous. In the maxilla, an anterior bridge was present. The right molar region was edentulous. The oral tissues were normal. The anterior region of the mandible was very sensitive to pressure, and the anterior ridge of the mandible presented soft, movable tissue. Occlusal roentgenograms (Fig. 1) revealed a thin labial and a normal lingual plate of bone surrounding the impacted tooth. The extra-oral anterior view

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revealed that the impacted tooth extended vertically the full depth of the mandible, a distal curvature of the root, approximately 2 mm., following the normal contour of the lower border of the mandible. (Fig. 2.)

Diagnosis.—The diagnosis was impaction of a left cuspid in the symphysis of an edentulous mandible, completely encased in osseous structure, with the exception of the incisal surface. The prognosis was considered favorable, but the probability of an operative fracture was recognized.

Operation.—After a preoperative survey, a splint was constructed (Fig. 4, left) to be used in the event of fracture or as a treatment splint for added support in the case of non-fracture. The operation was performed March 14 under conductive anesthesia, right and left mandibular block. A horizontal incision was made from the bicuspid to the bicuspid region through the soft mov-

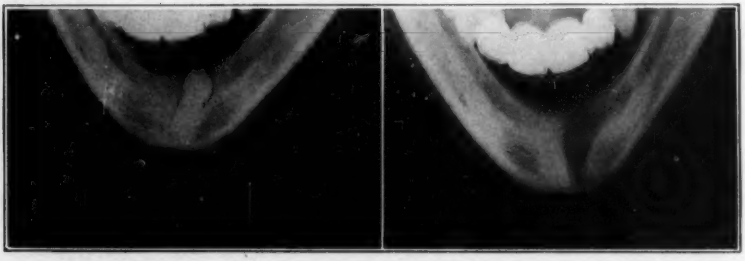

Fig. 3.—Left: Extra-oral x-ray film of symphysis (film held beneath chin). Right: Postoperative view.

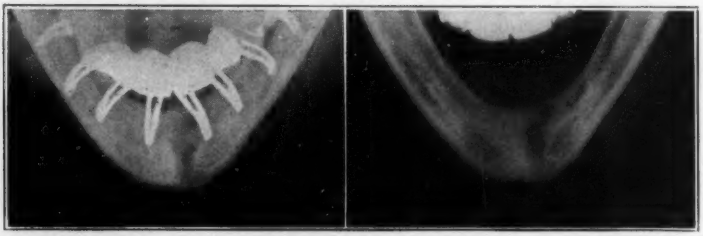

Fig. 4.—Left: Mandibular alveolar splint for use in event of operative fracture. Right: Bone regeneration one year after operation.

able ridge. A periosteal flap was made and the incisal surface of the tooth was exposed. With an incision following the natural contour of the crown, the bony process was removed and the labial surface of the crown exposed. The undermining of the adjacent osseous structures allowed a mesial, distal movement of the long axis of the tooth in its socket. By wedging force on the distal surface, between the tooth and the bony wall, the apex (or hook) of the root was fractured and the removal of the tooth and its apex separately was permitted. The socket was curetted, the bone beveled, the socket medicated with surgical dressing and the flap sutured.

Course.—The splint was seated and held in position by a jaw bandage and the patient was instructed to wear the splint daily for a time, to support and protect the mandible.

An immediate postoperative roentgenogram revealed that the tooth was removed without fracture of the mandible and with little destruction of the surrounding osseous tissues.

The patient, who was kept under x-ray observation and under treatment, stated that she experienced little postoperative discomfort and was greatly relieved mentally. April 1, the splint was removed permanently, and the case was dismissed May 23, with a very gratifying result.

The patient was instructed to return periodically for roentgenographic examination. The last roentgenogram was taken March 12, 1943. (Fig. 4, right.)

1046 Hollywood Boulevard.

Internist's Problem in Anesthesia.—The preparation of a patient to receive an anesthetic for a surgical operation is in reality more important than the postoperative care, for if there has been ideal preoperative attention, there will be little need for postoperative management. In addition to the comfort of the patient in the postoperative days and to his general health during and following convalescence, there is an economic problem to be considered, viz., the number of days in the hospital. It is an investment for the patient, and not an expense, for him to be put into the best possible condition before any surgical procedure and to have the anesthetic administered in as skillful manner as can be done only by the expert anesthetist, for these will reduce his hospital days and nursing hours. Many people, and most surgeons, think it is sufficient that the patient recovers from the operation, and scant attention is given to how long it takes to return to normal or what degree of comfort is experienced during this time. Everything is judged by comparison. Few patients have had a previous operative experience and if they are weeks in recovering normal health they believe it was due to the serious condition they were in. They do not appreciate the fact that many details in their particular cases were overlooked.—A. H. Waterman, in *Am. J. Surg.*, 1927.

MANDIBULAR CYST TREATED BY X-RAYS: REPORT OF CASE

NORMAN LUSSIER, D.D.S., San Francisco, Calif.

IT is well known that the internal secretion derived from the parathyroid glands has the ability to raise the level of the blood calcium. In other words, the normal blood calcium, which is between 9.5 and 12 mg. per hundred cubic centimeters of blood serum, may be raised to the level of 15 or 20 mg. per hundred cubic centimeters, and, in the presence of an increased blood calcium, there is an increased calcium excretion. Consequently, with prolonged hyperactivity of the parathyroid glands and maintenance of a relatively high blood calcium, there is a definite tendency to withdrawal of calcium from the bones. The blood calcium content being independent of the body calcium intake, an unusual amount of calcium has to be taken in to offset a negative balance and a generalized osteoporosis.

According to Gilbert Key, of St. Louis, many clinical cases have been observed in which the presence of adenoma of the parathyroid glands was accompanied by generalized osteoporosis or the pressure of bone cysts or giant tumors. Such a case was reported by Hermann Becks about ten years ago at a joint meeting of the San Francisco medical and dental societies.

The exact relation between the hyperactivity of the glands and local bone lesions has not yet been worked out, but chemical evidence is accumulating that the hyperactivity may be a causative factor.

X-ray therapy is indicated in the treatment of such bone lesions, along with x-ray therapy of the parathyroids. Other mouth conditions in which x-ray therapy is indicated are: osteomyelitis, to prevent the fulminating type; certain benign tumors and malignancies about the face and jaws, in conjunction with the regular surgical and other therapeutic treatment, and so-called sterile cysts and traumatic cysts, and in promoting bone regeneration of large cystic areas after surgery.

If a sufficient number of practitioners were contacted, many instances of x-ray therapy in dento-oral conditions might be revealed, but not many cases have been reported in the literature.

Among a number of men contacted, only one had used x-ray therapy in the treatment of cysts of the jaws. I have had two cases, one of which I am reporting at this time. One I class as a sterile bone cyst, the other a retention cyst, which may have been radicular or follicular. This report covers the first, the sterile bone cyst.

A woman, aged 31, complained of fulness and pressure in the lower left cuspid region. Roentgenographic examination revealed a large bone cyst be-

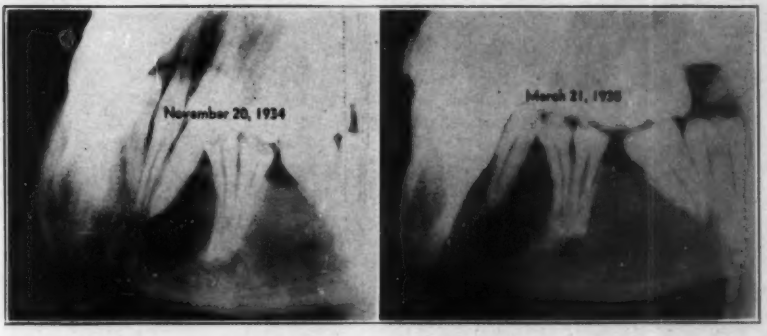

Fig. 1.—Left: Pretreatment x-ray film. Right: Early results of x-ray therapy.

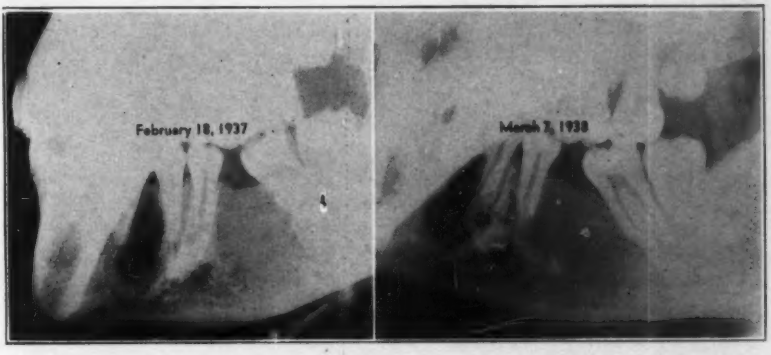

Fig. 2.—Progressive improvement following x-ray therapy covering period from November 22 to December 17, 1934.

Fig. 3.—Final x-ray film, showing improvement after five years.

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tween the lower left cuspid and the first bicuspid. These teeth were vital and were outside the cyst formation and separate from it. There was no history of trauma in the area that the patient could recall. As she refused to have a surgical operation, x-ray therapy was suggested. This she submitted to, and from November 22 to December 17, 1934, eight x-ray treatments were given. A total of 800 roentgen units were delivered over the left side of the mandible, 800 units to the left parathyroid area and 800 units to the right parathyroid area. The factors used were as follows: 200 K.V.P., 0.5 mm. copper and 1 mm. aluminum filter, at 50 cm. distance.

The patient reported that, after the series of x-ray treatments, the sense of fulness in the left lower cuspid region had disappeared. She was satisfied that she would get well without any other therapy, but she was instructed to return periodically for a roentgengraphic check-up. The accompanying roentgenograms taken over a period of five years show the result of the x-ray therapy.

The blood calcium report, November 14, 1939, showed: inorganic phosphorus, 4.01 mg. per hundred cubic centimeters; serum calcium, 10.05 per hundred cubic centimeters, well within the normal limits.

450 Sutter Street.

Nearer Causes of Cancer.—Those carcinogens which merely provoke the disease are crucial to it nevertheless, since without them it would not occur. Many are so powerful, the roentgen rays and certain synthetic hydrocarbons for example, that they bring tumors into being which under ordinary circumstances would never occur. They crash the gates of ordinary insusceptibility. Not a few agents to which man unwittingly exposes himself under the circumstances of ordinary life are scarcely less effective. A list of the human tumors which have been traced to the action of provocative carcinogens is in no small degree a sociological document, reflecting as it does the ways of life, vocations, avocations, habits and environmental stresses of peoples and individuals. The occurrence of betel nut cancer in Siam, of kangri cancer in Kashmir, of mule spinners' cancer in England and of osteosarcoma due to radium emanation in the United States demonstrates as clearly as the experimental findings in mice that every animal body possesses a myriad of potentialities for tumor formation and that only by good fortune do most human beings slip through life without the realization of a single one of them.— PEYTON ROUS, in *J. A. M. A.*, June 26, 1943.

IRIDOCYCLITIS APPARENTLY OF DENTAL ORIGIN: REPORT OF CASE

FRANK S. TICHY, D.D.S., Evanston, Ill.

History.—R. A. K., a man, aged 49, married, weight 150 pounds, height 68 inches, gave an essentially negative family history. He had had the diseases of childhood. He stated that he had enjoyed excellent health up to the time (one year before) of serving in the tropics, when he observed redness of the sclera of the right eye. The chief complaint was failing vision, photophobia and lacrymation of the right eye.

Three months after the onset of the condition, the patient sought relief at a hospital, where he was told that he was suffering from iridocyclitis caused by a dental focal infection. At this time, measures were taken immediately to eradicate the infection by the removal of three hopelessly diseased (abscessed) teeth: the upper right first molar, upper right second bicuspid and the upper left cuspid.

About one month later, test revealed that vision in the right eye was 6/20 and in the left eye, 8/20. The patient did not seem to be relieved of his earlier symptoms. He continued wearing dark glasses.

Six months after the onset, tests showed vision in the right eye to be 4/20; in the left eye, 14/20.

Nine months after the initial onset, tests showed vision in the right eye to be 1/20; in the left eye, 10/20. Glasses were then prescribed. A group of medical examiners stated that the "condition of the right eye was chronic and becoming slowly but progressively worse." The patient was then referred to an eminent oculist. At this time, the findings of another dental examination were as follows:

Good mouth hygiene. The patient has a well-fitted upper artificial denture. The pulps of all the remaining teeth are vital. The soft tissue of the mouth, fauces and posterior wall of the pharynx are normal except at one point in the area of the extracted right upper molar. Here, the soft tissues are boggy and a slight pressure produced a little serous pus. A loopful of this pus was collected for culture. The culture was overgrown by a spore bearer.

Examination.—Roentgenograms showed some bone destruction in the right maxilla. A tentative diagnosis of radiculodental cyst was made.

Operation and Laboratory Data.—A few days later, under procaine anesthesia, an incision was made over the affected area, exposing an area of approximately 3 by 4 cm. of destroyed bone, extending posteriorly to involve the second upper molar tooth, and upward to the floor of the antrum, which was partly destroyed. The cavity contained no fluid, although a small fistulous opening was found near the mucobuccal fold.

Débridement was carried out, followed by phenol-alcohol cauterization. A biopsy of the epithelial lining fragments showed that tissue fragments were chronically inflamed. Microscopically, the section showed granulation and fibrous tissue lined with thick stratified squamous epithelium, with marked

chronic inflammatory changes. There was infiltration mostly by lymphocytes, with a fair number of pus cells. The diagnosis was chronic inflammatory radiculodental cyst.

Three days after débridement and removal of the cyst wall fragmentations, the oculist reported increasing cloudiness of the cornea. Apparently, the flare-up or exacerbation was due to surgical interference.

Outcome.—Ten days after the operation, the surgical wound continued to heal nicely and the eye showed a decided improvement.

One year after the operation, tests showed a vision of 8/20 in the right eye; 12/20 in the left eye. The eyes were clear and the patient was free of photophobia, lacrymation and injection of the sclera.

Comment.—In a case of iridocyclitis resulting from a dental focal infection, although the source of infection was seemingly removed when the infected teeth were extracted, the eye symptoms persisted and damage to the eyesight continued. A second dental examination, however, revealed that the infection was not eliminated by the extraction of the infected teeth. After débridement, the removal of cyst wall fragments and cauterization, the eye condition cleared up and the patient had fair vision. In the opinion of Lebensohn, the damage to vision resulting from iridocyclitis due to dental focal infection may not be permanent if the infection is eliminated.

Lebensohn writes:

The impaired vision was probably due to cloudiness of the vitreous, incident to the exudation from the inflamed uveal tract. With the disease arrested, no further exudates will be poured into the vitreous and the vitreous haze already present will probably clear to a large degree from absorption.

1125 Davis Street.

Use and Abuse of Antiseptics.—Lister's aim was to produce an aseptic wound by antisepsis, but he quite realized that where infection was minimal, aseptic technic could produce as good results as the antiseptic method. He wrote: "These two great truths have been taught us by advancing science, that normal serum is not a good soil for the development of attenuated microbes and that bacteria introduced among the tissues, if in not too concentrated form, are disposed of by phagocytosis." Those who stress the damage done by antiseptics to the tissues are only following the lead of Lister, who wrote: "In treating surgical cases antiseptically I always endeavour to avoid the direct action of the antiseptic substance upon the tissues, so far as is consistent in the existing state of knowledge with attaining the essential object of preventing the development of injurious microbes in the parts concerned."—Zachary Cope, in *Am. J. Surg.*, 1930.

MIXED TUMOR OF THE PALATE PRESENTING ITSELF AS A CYST: REPORT OF CASE

FRED A. HENNY,* D.D.S., Detroit, Mich.

INTRA-ORAL mixed tumors of the salivary gland type are not rare. They may be seen in almost all of the associated structures about the mouth, having been reported in the hard and soft palates, the cheeks, the floor of the mouth, the lips and even within the mandible. The common site is the palate, where the clinical picture is ordinarily typical and the diagnosis relatively simple. There is a firm, sometimes nodular, slow-growing painless tumor arising from either the hard or the soft palate, usually away from the midline.

Differential diagnosis must be made only among osteoma, (torus palatinus), mixed tumor and fibroma or fibropapilloma. The elimination of torus palatinus, which always occurs in the midline and is a definitely bony process, is not difficult. Fibromas or fibropapillomas rarely occur in the palate and are more likely to have a pedicle attachment than is the mixed tumor.

The following case report is of interest, not because of the diagnosis of mixed tumor, but because of the incorrect preoperative diagnosis.

History.—A woman, white, middle aged, moderately well developed, came in for examination, December 1, 1941. The chief complaint was "swelling under the upper plate." There was a history of wearing an upper denture for the past seven years, which had been entirely satisfactory until about six months earlier, when the patient noticed a recurrent swelling of the palate. On several occasions, her physician aspirated the mass, obtaining a clear fluid each time.

Examination.—A small well-circumscribed fluctuant swelling was noted in the left lateral portion of the soft palate, extending sufficiently into the hard palate to interfere with the upper denture. Some scarring of the mucous membrane was apparently due to repeated aspiration. The remainder of the examination was essentially negative.

Preoperative Diagnosis.—The diagnosis was mucocele of the palate.

Operation.—The area of operation was anesthetized by procaine infiltration and the dissection was begun around the cystic sac. However, when the deeper structures were exposed, a multiplicity of cysts were found. As these were gradually circumscribed by the dissection, a large well-encapsulated mass was exposed. It was firm, lobulated and smooth, except in areas where small cysts were apparent, and was typical of a mixed tumor of the salivary gland type.

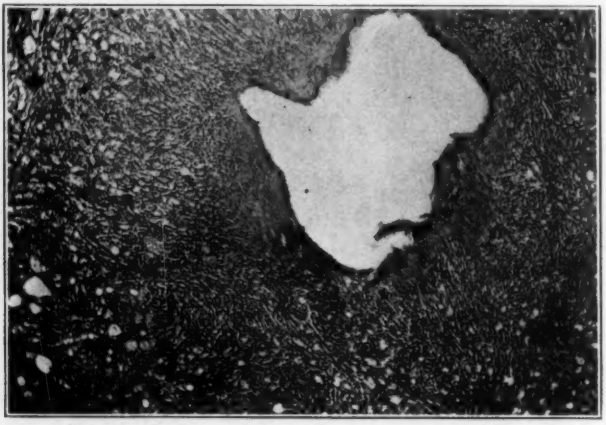
Since I wished to avoid cutting through the posterior border of the soft palate, if possible, the incision was limited in length, this making the dissection difficult and the mass resistant to delivery. The tumor extended from the midline laterally, so that its extreme lateral pole was just beneath the posterior border of the ramus, near the angle. The dissection was completed and the

*Associate surgeon, Division of Oral Surgery, Henry Ford Hospital.

mass was removed *in toto*. No serious bleeding was encountered, although the strong possibility of breaking into the internal maxillary artery was ever present during the terminal stages of the procedure. Sulfanilamide was dusted into the defect and a light packing of vaselin gauze was inserted. The mucosa was closed with silk.

Pathologic Examination.—Gross: The specimen consisted of an encapsulated tumor measuring 4.5 cm. in diameter. It was firm, and section revealed that it was composed of a grayish white, translucent tissue with a few pale yellow streaks. In one area, a small collection of a gelatinous material was seen. It was believed to be a mixed tumor.

Microscopic: Section through the tumor submitted revealed an essentially solid structure, although scattered throughout were a few small cystic areas filled with pink-staining material. The solid areas were made up of a dense collagenous connective tissue, scattered throughout which were numerous



Photomicrograph of mixed tumor of palate.

spindle-shaped and oval nuclei. In some areas, these were arranged to form more or less well-differentiated alveoli; and, in these areas, they had the appearance of epithelial cells. Scattered throughout the tissue were numerous small islands of bluish-staining myxomatous-appearing tissue. In one area, there was a small island of substance that had a cartilaginous appearance. This type of tissue is not usually seen in this type of tumor. However, it was quite definite and the appearance on the whole was that of a mixed tumor, although there were some atypical features. The diagnosis was mixed tumor.

The postoperative course was uneventful and there has been no recurrence to date. It is to be noted that the tumor was so located that palpation of the mass was impossible. The only feeling in the palate was one of fluctuation. Evidently, there were sufficient secretory elements present to form a multiplicity of cysts, one finally becoming evident through the oral mucosa.

It is important to note that mixed tumors may present themselves as cysts, and the possibility of underlying tumors must be kept in mind.

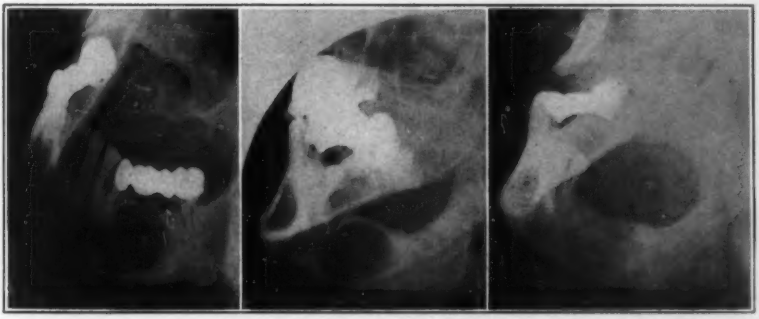
RESIDUAL ROOT CYST OF THE MANDIBLE: REPORT OF CASE

H. NEWMAN BROWNSON, D.D.S., Hollywood, Calif.

History.—Mr. C. A., aged 59, seen February 1, 1940, complained of pain in the lower left molar region, occurring off and on for three or four months, but never exceeding a mild toothache. The patient stated that, at the age of 17, the left side of the jaw was struck by a baseball. Inflammation followed for a normal period with no apparent abnormal results at that time. At the age of 35, the lower left first and second molars were extracted.

Examination.—The maxilla was edentulous. The mandible had two posterior stationary bridges running from the third molar to the second bicuspid, on the right and left sides. The oral tissue was normal. The body of the left side of the mandible was tender on pressure and the left third molar was tender on percussion. There was some numbness in the lower left lip.

An intra-oral roentgenogram of the lower left third molar revealed a radio-



Left: Residual cyst of mandible. Center: Postoperative roentgenographic appearance. Right: Bone regeneration two years after operation.

lucent area at the apex of the roots. The anterior portion of the film showed a part of a large radiolucent area, and an extra-oral, or lateral, roentgenogram of the body of the mandible in turn revealed a large circular radiolucent area in the body of the mandible.

Diagnosis.—Root-end granuloma (abscess) of the lower third molar was diagnosed. There was a large cyst in the body of the left side of the mandible and the second bicuspid extended into the cystic area. The prognosis was considered good.

Operation.—Under pentothal sodium anesthesia, the bridge and abutment teeth were removed and an incision was made horizontally from the left third molar along the crest of the ridge anteriorly from the left first bicuspid, and a periosteal flap was turned, a plate of bone of eggshell consistency being re-

vealed in the edentulous area. This was removed with a small pair of bone scissors, a half-moon shaped opening approximately one-half inch on its base exposing the fibrous wall of the cyst. An attempt to aspirate the contents of the cyst met with failure, and a ligature was placed for traction and the fibrous wall incised, a very thick cornmeal-like substance being revealed which had to be spooned out of the cyst to permit the fibrous wall to collapse within the bony cavity. The incised fibrous wall was sutured and the cyst sac enucleated. The bony walls of the cystic cavity were dusted lightly with sulfanilamide powder and the periosteal flap was sutured. The sutures were removed after eight days. A healthy union had taken place along the line of the incision.

Outcome.—Postoperative roentgenograms taken February 14, 1940, and April 6, 1942, showed a favorable end-result.

Preanesthetic Medication.—Any drug which will produce sufficient hypnosis to spare the patient the dread of an operation without, at the same time, endangering his welfare or creating difficulties in local and inhalation anesthesia, must be welcomed as a desirable adjunct to preanesthetic medication. A patient's reaction to anesthesia and surgical intervention is the total of all stimuli that reach the brain. Dental and oral surgeons are apt to minimize the effect of the emotional and psychic phenomena on a patient about to undergo an operation. What is a commonplace experience to anesthetists, dentists, surgeons and hospital attendants is an adventure of terrifying and surprising magnitude to a great many patients. If the patient is hospitalized, the preparation for operation, the preliminary hypodermic, the change of body apparel, the trip on a stretcher, the handling of instruments, the "scrubbing up," and finally the presence of the mask over the face until the patient thinks he is suffocating, all have a corresponding reaction, in many cases out of all proportions to the surgical trauma inflicted in the operating room.—C. H. Burmeister, in *J.A.D.A.*, 1933.

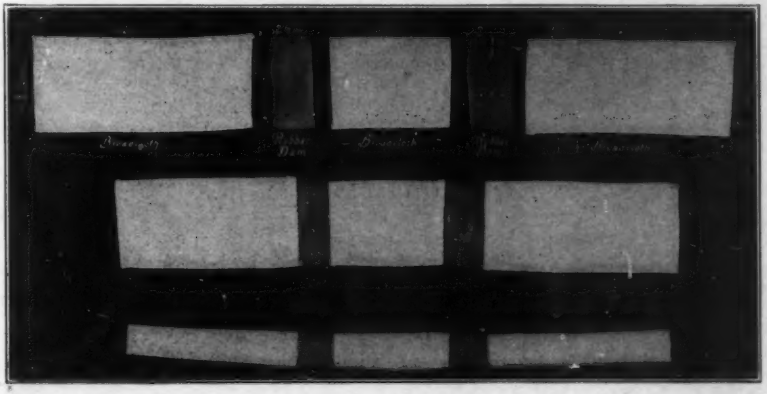
HANDY BANDAGE

H. Newman Brownson, D.D.S., Hollywood, Calif.

A bandage that is easily adjusted to fit individual cases is used in conjunction with an operating cap or stockingette in emergency and other jaw cases when external traction is required.

The bandage is made up in small, medium and large sizes, of firm cloth (Indian head or other suitable material). The medium size requires two 12-inch and one 6-inch length strips 6 inches in width; also 6 inch widths of rubber dam cut in two 3-inch lengths. This rubber dam is machine stitched at each end of the 6-inch length of material and fastened to one end of each of the 12-inch lengths. This makes a bandage 34 inches long and 6 inches wide with two rubber inserts.

The bandage is folded with two creases, giving three layers of cloth, so that it can be adjusted to fit under the mandible without impingement on the throat



Above: Units making up bandage. Center: Completed bandage. Below: Bandage folded to fit under mandible.

and will not extend over the anterior border of the mandible. It is then brought up on the right and left sides of the face and the ends are attached to the head-cap to give the required traction. The bandage is anchored to the cap by means of paper staplers or safety pins and adhesive tape.

A J&J throat pack is used for padding between the jaw and a bandage under the mandible. The bandage, having elastic traction, can be easily adjusted to give the required support and fit the mandible comfortably.

A stock of these bandages, preferably two of each size, should be on hand at all times.

This type of emergency traction could be used conveniently in the Army by attaching the bandage to the soldier's service cap.

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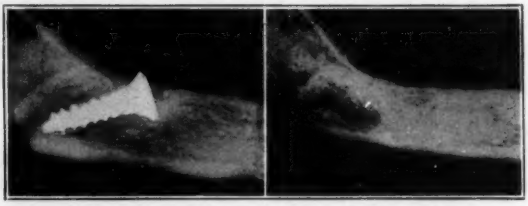
FOREIGN BODY (SCREW) IN MANDIBLE: REPORT OF CASE

G. Calvin Marlow, D.D.S., San Diego, Calif.

History.—A woman, of German descent, complained of trifacial neuralgia. Twenty-five years before, a metal screw had been placed in the left side of the mandible in a dental office in Sioux City, Iowa, in an effort to relieve a tic douloureux caused by nerve irration from extraction of a molar. The screw was placed in the bone to keep the severed ends of the inferior alveolar maxillary nerve from uniting. Since no relief ensued in a year's time, the patient was taken to the Mayo Clinic. Alcohol injections gave relief for four weeks, when the treatment was repeated, with a further period of freedom from pain of three weeks. One week later, surgical measures were taken, the operation



Left: Preoperative roentgenogram. Right: Postoperative view, showing bone regeneration.

being completed after an interval of two weeks. The operation was thought to have been a retrogasserian neurotomy. Relief had been effected, with no pain for twenty-five years.

Examination.—Considerable infection was found around the screw, with pain.

Treatment.—The screw was removed and the pain left almost immediately. (The patient had refused to have the screw removed at the time of the operation.)

Outcome.—A year later, there had been no recurrence of trouble. A preoperative roentgenogram was taken in this office before removal of the screw. A postperative film taken May 14, 1943, shows fairly satisfactory bone regeneration.

Book Notices and Reviews

INDEX TO DENTAL LITERATURE. Published by the American Dental Association, Chicago, Ill. Price $7.50.

This latest index of dental literature in the English language, covering three years, 1939-1941, has been considerably simplified and made much more adaptable to the needs of the dental profession. Books published during the period, as well as the journals, are listed.

The index is arranged alphabetically according to subjects and authors, and subheadings have been added where indicated to assist the reader in looking up references on specific subjects. Subject headings are shown according to the nomenclature in current usage. Articles appearing under subject headings list the name of the author first, and the typographical arrangement is such that articles by certain authors are readily found. This arrangement is of decided advantage in selecting a group of articles on a specific subject by certain authors from a large group of references on the subject. This is particularly true when several men with the same surname have written on a given subject.

Subjects on oral surgery are adequately indexed, and the cross-references are in most instances sufficient. In such subjects as cancer involving the mouth and jaws, and in fractures of the facial bones, additional subheadings under the subject matter would be of service in articles covering several aspects of the subject, and in cases of specific consideration of the subject. These additional subheadings are being considered and will be added to subsequent indexes if the literature warrants them.

PRINCIPLES OF ORTHODONTICS. J. A. Salzmann, D.D.S. 674 pages. 450 illustrations. Price $10.00. Philadelphia: J. B. Lippincott Company, 1943.

This comprehensive text has been prepared with a great deal of care by the author, with the aid of a great number of distinguished specialists in the field of orthodontics, who read the manuscript and offered criticisms as well as provided him with a great number of original illustrations. This collaboration has resulted in an outstanding and authentic text on the subject, complete in every detail. Since the importance of orthodontics and preventive dentistry is well established, the general practitioner of dentistry or the oral surgeon will find this book stimulating and very helpful in his practice, as it will enable him to render greater service to his patients. The subject matter is well arranged and exceptionally well illustrated. Each chapter is prefaced by a summary outline which brings out the important considerations and practical applications of the subject of the chapter. The entire subject of growth of the body and development is presented from every aspect and amplified by numerous illustrations, tables and charts. The causes of retardation of body growth and the effects of disease on growth are amplified. The references on this subject are complete.

Bone growth and the carpal index are extensively covered in Chapter 4.

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The section on the development and growth of the head is complete, covering the prenatal and postnatal skull growth with particular emphasis on the growth of the face and jaws. The growth of the face in relation to dentition is covered in great detail and illustrated by diagrams and numerous charts. The sequence of facial growth is likewise presented and there is an excellent summary at the end of the chapter. The relation of function and form is discussed in the chapter on developmental fundamental anatomy and physiology of the face and jaws. In this chapter, the growth of the mandible and maxillae, the mouth and the lips in relation to the function of the muscles is presented in detail.

Chapter 7, covering the development of the dentition, is complete in every detail and well illustrated. This chapter is followed by one on anomalies of tooth eruption and formation. Chapter 9 is devoted to ontogenetic development of the occlusion of the teeth, including the relationship of facial growth and occlusion of the teeth. Dental facial deformities are discussed from the standpoint of endocrine disturbances and nutrition. The chapter on etiologic factors in dental facial deformities is fully discussed and well classified from the standpoint of genetics and heredity. Included is a discussion of abnormalities that may be associated with congenital cleft lip and palate. Postnatal dental facial anomalies are classified as developmental, deficiency and functional and environmental disturbances. This classification covers a wide group of deformities and is of great importance to the oral surgeon. Chapter 14 is devoted to differential diagnosis and prognosis, with particular reference to the deciduous teeth as an indicator of the normality of the permanent dentition. In the discussion of the mixed dentition, the frenum labii superioris is noted in its relation to the normal separation of the incisors. However, the reasons for or against surgical removal are not adequately discussed. The differential diagnosis of the permanent dentition and the prognosis of dental facial anomalies are discussed. The chapter on orthodontic examination of the patient is complete in every detail, including a comprehensive record system covering the medical and dental history of the patient, as well as of the family, and records of the systemic, dentofacial and dental examination. Anthropometric examination is discussed and the construction of orthodontic dental casts and face masks is described. The portion of the chapter dealing with roentgenography is detailed as to technics, positioning and exposure. The same is true of the portion devoted to photographic examination of the entire face and facial profile and for the photography of dental casts of dental arches. Elaborate tables are shown on illumination and exposure technics.

The concluding chapters of the book cover the subject of the prevention and treatment of incipient malocclusion and the classifications and technics and appliances used for well-established cases of malocclusion. The concluding chapter covers the tissue reaction and bony changes incidental to tooth movement and the orthodontic change in jaw relationship.

From a surgical standpoint, an operation for the exposure of unerupted maxillary cuspids is well illustrated.

A valuable addition to this comprehensive text would be a chapter on the subject of prognathism, classifying the cases that past experience has proved not to be amenable to orthodontic treatment, but that can, by the aid of surgery, be at least greatly improved if a reasonably normal occlusion cannot

be anticipated after surgical repositioning. This should include a frank discussion of the various methods employed by surgeons in this field. This book is highly recommended to the general practitioner and the oral surgeon, as well as to men specializing in orthodontics.

INTERNAL MEDICINE IN DENTAL PRACTICE. By Bernard I. Comroe, A.B., M.D., F.A.C.P., Associate in Medicine in the School of Medicine and Dentistry of the University of Pennsylvania; Leon H. Collins, Jr., A.B., M.D., F.A.C.P., Associate in Medicine in the School of Medicine, Instructor in Medicine in the School of Dentistry, University of Pennsylvania, and Martin P. Crane, B.S., M.D., Instructor in Medicine in the Schools of Medicine and Dentistry of the University of Pennsylvania. Second edition, enlarged and thoroughly revised. Octavo, 543 pages; illustrated with seventy-six engravings and six colored plates. Cloth. $5.50. Philadelphia: Lea & Febiger, 1942.

This considerably enlarged and completely revised second edition contains many new engravings. There are fourteen parts, including new sections on focal infection and on sulfonamides especially with reference to sulfadiazine and the newer compound penicillin. Diseases of the heart and blood vessels, the respiratory tract, the gastro-intestinal tract, the kidneys and urinary tract and the nervous system are covered in the first five parts.

The relationship of renal disease to dentistry is briefly discussed and well summarized in box form. The chapter on disease of the nervous system presents an excellent summary of this subject and a number of the conditions associated with pain in the facial regions are discussed briefly.

From the standpoint of the oral surgeon, this text provides much helpful information in matters of diagnosis and therapy. The patient with heart disease undergoing dental surgery may by intelligent preoperative handling become a better operative risk, and the authors present in detail the steps that should be taken by the dentist to guard against ontoward complications. The treatment of cardiovascular emergencies is adequately presented.

Part six covers endocrinology effectively, and the dental conditions associated with abnormalities of endocrine gland function are discussed at length. Diseases of the blood and blood-forming organs, the infections, eye, nose, pharynx, mouth and salivary glands are covered in parts seven to ten inclusive.

The chapter on diseases of the blood and blood-forming organs is comprehensive from every standpoint, and the relationship to dentistry, including precautions in handling patients with these conditions, is well presented.

A complete classification of diseases of the joints and related structures is presented in part seven, and the various conditions are discussed, including the involvement of the temporomandibular joint in rheumatoid arthritis.

Part eleven covers the subjects of allergy, deficiency diseases and vitamins in a greatly condensed form, which might well be expanded considerably in future editions. Chemical poisoning and intoxication, including oral manifestations, are covered in part twelve. The discussion on foci of infection in section thirteen is excellent and is presented in a logical, practical manner. The author's viewpoint is conservative and is thus expressed: "Definite focal infection in the body is harmful to the patient regardless of his disease." He decries

the present wave of extreme antagonism to the concept of focal infection as evidenced by the opinions of some internists, and considers that such negativism is as erroneous as the concept that all arthritis, nephritis, iritis, endocarditis, etc., are caused by focal infection. The boxed summary forms appearing throughout the entire text, which outline the important points in diagnosis and therapy, are particularly effective in this section and of practical value to the dentist and oral surgeon. The final section on sulfonamides and gramacidin and penicillin is well arranged and authentic in every particular. Presented in abstract form, it contains a great deal of information for the dentist. It might well be enlarged to cover in greater detail the administration of the sulfonamides in infections of the jaws and associated tissues.

This book is adequately illustrated and photographs or plates of mouth lesions are included in the text when indicated to show the oral manifestation of the disease under discussion. The bibliography is complete and up to date and is placed at the end of each section except where, for convenience, references are placed after subsections of a chapter. This text is recommended as an excellent source of information concerning the relation of internal medicine to dental practice, and should be of value to every practitioner of dentistry. Once familiar with its contents, the reader can quickly secure valuable information on any medical condition.

C. W. W.

PRACTICAL ANESTHESIA FOR DENTAL AND ORAL SURGERY LOCAL AND GENERAL. Harry M. Seldin, D.D.S., F.I.C.D., F.I.C.A., Consulting Oral Surgeon, Harlem Hospital, New York City Cancer Institute and Peekskill Hospital, Peekskill, N. Y.; Honorary Professor of Major and Minor Surgery of the National University of Mexico. Second edition, enlarged and thoroughly revised. Octavo, 560 pages, 217 engravings. Cloth, $7 net. Philadelphia: Lea & Febiger, 1942.

This second edition has been completely revised and several chapters have been added to the second part, devoted to general anesthesia. These include an evaluation and discussion on inhalation anesthesia agents such as cyclopropane and vinethene, and intravenous anesthesia as used in oral surgery, and a lengthy discussion of anoxemia, particularly with reference to nitrous oxide-oxygen anesthesia and anesthetic and postanesthetic deaths.

The first part of the book covers the subject of local anesthesia in a comprehensive manner. In the opening chapter, the author discusses anesthesia in general and lists the conditions in which local or general anesthesia is indicated. The second chapter is devoted to the anatomic basis for local anesthesia, a thorough knowledge of which is essential to successful local anesthesia. The practical application of this subject to injection technics is stressed and the numerous illustrations of the bony structures and associated soft parts are helpful to the dentist in his work.

The composition and the preparation of anesthetic solutions, including the newer anesthetic agents and vasoconstrictors, and their relative efficiency and convenience are discussed in detail. This affords the reader a means of choosing the type best adapted to his needs. Complete information is provided re-

garding the types of hypodermic syringes and needles and their care, as well as the other instruments necessary for local anesthesia and the preparation for and manner of their use.

The technics of field block or infiltration anesthesia is presented in detail, including the formulas and use of topical anesthetics to render the insertion of the needle point less painful. This chapter also includes the technics for paraneural injection of nerves lying close to the mucous membrane, such as the long buccal anterior palatine and nasopalatine. Supraperiosteal, subperiosteal, intraosseous and pericemental infiltration are evaluated in a comprehensive manner.

The various methods of securing intra-oral block anesthesia of the mandible are profusely illustrated with dissections, drawings and diagrams to show the anatomic considerations, and the reasons for failure to secure adequate anesthesia are fully discussed. The various technics of injection, such as the Fischer 1, 2, 3, the single path and the straight line modifications necessary in the case of children are included and the incisive nerve (mental) injection is well portrayed.

The subject of anesthesia of the maxilla is presented in the same thorough, well-illustrated manner, including the various extra-oral technics for maxillary or second division block.

The practical applications of local anesthesia are covered in valuable chapters of this text, which will be found very instructive to the reader.

The second part of the text presents the subject of general anesthesia in oral surgery in a comprehensive manner. The indications for its use and a practical method of physical diagnosis for use by the dental anesthetist in determining whether the case presents a good or a poor anesthesia risk are discussed. There follow chapters on the physiology of inhalation anesthesia, including the rôle of oxygen and control of respiration. The effect of nitrous oxide on the human body is well presented and an excellent discussion of premedication and preanesthetic suggestions is included. About 170 pages are devoted to nitrous oxide anesthesia and the subject is covered from every angle for the guidance of the dental anesthetist. It is full of practical points on technics of administration including the management of children and the recalcitrant patient. All the commonly used appliances and apparatus are described and adequately illustrated.

The newer anesthetics, cyclopropane and divinyl ether (vinethene) are discussed briefly. The use of the latter in oral surgery is noted. A brief discussion of ethyl chloride as a general anesthetic is presented, with its application to dental surgery. A short discussion of somnoform is included in the text.

The chapter on intravenous anesthesia might well be expanded in view of the fact that this form of anesthesia is used frequently in hospital practice in oral surgical cases and its use is increasing in specialized office practice where the equivalent of hospital facilities and well-trained anesthetists are available.

The concluding chapter on resuscitation is complete in every detail and well illustrated. A careful study of this chapter should give the experienced dental anesthetist added confidence and skill in meeting emergencies calling for resuscitation measures. This book is highly recommended as a helpful text for dentists and as a reference book in anesthesia. C. W. W.

Current Literature

CLEFT PALATE. George M. Dorrance, M.D., and John Bransfield, M.D.

The authors present a profusely illustrated summary of their extensive experience in cleft palate surgery, particularly from the standpoint of speech and phonation. From their earlier experience, they had concluded that there were numerous cases wherein the palate could not be brought to the posterior wall of the pharynx, but their continued experience with the so-called "push-back" operation has shown them that, with the passing years, this group has been greatly reduced.

Two additional procedures are described. The first is the utilization of the mucoperiosteum of the vomer for the purpose of closing the cleft of the hard palate. In unilateral clefts, the incision is made along the junction of the mucous membrane of the vomer and the mucoperiosteum of the palate on the long side. The mucoperiosteum of the vomer is then elevated and hinged over "leaf-of-the-book-wise" and its incised edge is sutured under the elevated margin of the mucoperiosteum of the short side of the cleft, raw surface to raw surface. This operation is performed about the second year of the patient's life or later.

The second new procedure is the lining of the palatal mucoperiosteum with a Thiersch or split skin graft as the initial stage in their "push-back" operative technic. This eliminates a considerable area of raw surface on the nasopharyngeal surface which, in their original "push-back" operation, took some time to granulate and epithelize. This was accompanied by annoying crusting and often with considerable contracture of the flaps, which is either completely eliminated or greatly minimized by the skin grafting of the nasal surface of the pushed back palate. The skin grafting technic is fully illustrated in color, as well as the necessary maintenance of pressure by the use of a gauze dressing held in position by silver wires across the palate. In the last ten cases, the authors used a sectional acrylic splint identical with the Army dental type, with the addition of loops on its palatal margin, to which the silver wires are attached to hold the gauze dressing under pressure. They believe that this method of providing a lining is more satisfactory than attempts to elevate adjacent nasal mucoperiosteum and move it backward to cover the raw surface.

According to the authors, the older, well-established methods of operative treatment all too frequently required three or four operations to close the cleft, resulting in hardness and inflexibility of the palate that invariably led to poor phonation. They state that the conventional operations performed before the fourth year frequently failed wholly or in part. Their early experience with the "push-back" operation satisfied them that it overcame one of the chief faults of the standard cleft palate operations—a shortening of the palate. They were well aware that perfection had not been obtained. In this article, they discuss the various types of clefts of the hard and soft palate and describe the operative procedures planned to assure a palate of an adequate length for proper velopharyngeal closure. The steps in the procedures are amply illus-

trated, including the use of vomer flaps in bilateral clefts, the subsequent bilateral "push-back" procedures and closure of the clefts of the soft palate. A complete plan of repair of the clefts of the soft palate including skin grafting and two or three stage "push-back" procedures are discussed and illustrated step by step.

Secondary repairs of a palate, previously operated on and closed, are classified as operative successes, but there are sometimes resultant speech defects. Generally speaking, a modified "push-back" operation forms the basis of correction in the case of all patients who still have a palatal insufficiency and speak with the characteristic nasal tone. Results have been gratifying in that all cases have been improved. The conclusions are:

Operations designed for the simple closure of a cleft palate are not adequate for producing adequate speech.

The "push-back" operation, in our hands, has increased the number of satisfactory speech results in cleft palate patients. This is particularly true in patients who have had previous operations which resulted in but little speech improvement.

The surgical correction is based on findings as a result of original investigation, and in the anatomy of the velopharyngeal mechanism.

The "push-back" operation establishes the normal muscle and palate position, so that proper velopharyngeal closure is made possible.

The use of the vomer-flap transplant in cleft palate surgery has materially reduced the incidence of residual defects in the alveolar ridge. We feel that our modification of the method, by producing granulation with packing placed over the vomer flap, is essential if the "push-back" operation is employed.

The skin graft has produced a heavier flap of tissue and minimized tissue contraction following palatal surgery. It has also given us a higher percentage of closure in correcting secondary palatal defects.

Nearly all cleft palates show some degree of bone deficiency, and while each type requires a different operation, our basis of all corrective surgery is the "push-back" operation with variations for the individual case.

We do not advocate the use of pharyngoplasty as a routine procedure nor do we encourage posterior pillar surgery. Pharyngoplasty may be of great value in cases where the superior constrictor will not develop and produce Passavant's ridge or ring. There are cases that are surgically non-corrective because of insufficient tissue. The greatest gain in these cases is obtained by the use of an obturator. If, however, the "push-back" operation can be effected, even with a remaining defect in the anterior part of the palate, this is done, and the defect is covered with a small obturator.—*Ann. Surg.*, 117:1-27, January 1943.

DIAGNOSIS AND TREATMENT OF LUDWIG'S ANGINA. A. C. Williams, M.D., and W. C. GURALNICK, D.M.D.

The authors have made a study of Ludwig's angina for some time, and in this, their most recent report, they come to the conclusion that dental lesions were apparently the initiating factor in 90 per cent of the patients observed. In their earlier series, they had felt that dental pathosis was accountable for not more than half of the cases. They now consider dental infection as the most important factor in the condition and, for this reason, advise irrigating the mouth with a watery suspension of zinc peroxide powder before and after extractions. When oral infection is marked, the mouth should be irrigated at intervals for several days before teeth are extracted. After extractions have

been performed, the dentist should be on the lookout for evidence of spreading infection, to avoid delay in instituting treatment.

The diagnosis is established by the presence of inflammation, swelling and induration of the tissues of the sublingual space, with elevation and tenderness of the tissues of the floor of the mouth, which are frequently covered with a dirty grayish white exudate. Edema of the tongue may be moderate or extreme, and externally a rounded, tense and brawny, tender inflammatory swelling is found in the submaxillary space, chiefly in the suprahyoid region close to the jaw. Fluctuation is rarely seen in the early stages of the condition, if at all. In addition to the systemic symptoms accompanying severe infections, the patient usually has difficulty in talking and has profuse salivation and accumulation of mucus in the mouth and throat. Difficulty in swallowing and breathing may be marked.

In this recent series of fifty-three cases, the mortality was 10 per cent, in contrast to 54 per cent in the earlier series. The authors attribute this marked reduction to careful planning of the surgical treatment, which includes: 1. The establishment of an adequate airway by means of tracheotomy in patients having serious respiratory embarrassment, or exposure of the trachea before surgical drainage in patients who have slight or moderate difficulty in breathing. 2. Administration of sulfonamide drugs by mouth and locally. 3. Intravenous pentothal sodium anesthesia. 4. Bacteriologic examination of the exudate in order to determine the choice of postoperative dressings.

As already noted, the authors recommended a tracheotomy for patients who have marked difficulty in breathing, and for those in whom respiratory efficiency under a general anesthetic is not predictable, they feel that, as a precautionary measure, the trachea should be exposed through a transverse incision under procaine anesthesia. The wound should then be packed open with vaselin gauze and covered with a sterile towel for protection against possible contamination while the area of infection is opened. This precautionary measure affords quick access to the trachea should the need for tracheotomy arise.

The infected fascial space is drained by an incision made about 1 cm. below the body of the mandible and parallel to its lower border. The incision is started about 1 cm. in front of the angle of the jaw and carried across the middle line in cases that are more involved on one side. In bilateral involvement, the incision is continued on the other side to a corresponding point. The superficial fascia, platysma muscle, deep cervical fascia, anterior belly of the digastric muscles and anterior portion of the mylohyoid muscles are severed to widely expose the submaxillary and sublingual spaces. The posterior parapharyngeal space (lateral pharyngeal) should be opened if pus has entered it. The authors remove the submaxillary gland if it is found to be involved.

Instillation of from 5 to 8 gm. of sulfanilamide crystals into the area is recommended because streptococci are most frequently the outstanding organisms. The wound is loosely packed with iodoform gauze. If only streptococci are shown by smears and cultures, application locally of sulfanilamide crystals may be continued. If Vincent's organisms are demonstrated, zinc peroxide dressings should be used, being changed every four hours. If the infection clears up rapidly, secondary closure of the area may be feasible on the eighth day. The incision exposing the trachea may be closed on the third

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or fourth day or when the need for tracheotomy has passed. If a tracheotomy has been performed, the area and the tube should be kept scrupulously clean, and the cannula should be cleaned frequently during the day. The tracheal incision should be protected from contamination from the oral and nasal passages. The tracheotomy tubes may be removed when swelling has subsided.

Oral administration of sulfathiazole or sulfadiazine, initial dose 2 gm., followed by 1 gm. every four hours, is advised, but only as an adjunct to surgical drainage. Sulfonamides alone should not be relied upon to cure the disease. If the respiratory passages are clear, pentothal sodium administered intravenously is the preferred anesthetic.—*New England J. Med.*, 228:443, April 8, 1943.

RADIOLOGICAL EXAMINATION OF A FRACTURED MANDIBLE—A POSSIBLE PITFALL. E. A. Hardy, M.R.C.S. (Eng.), L.R.C.P. (Lond.), L.D.S. (Eng.)

The author discusses the problem of the removal or retention of teeth or pieces of bone in the region of fractures of the mandible, and reports a case of comminuted fracture involving a second molar and a semi-impacted third molar, with a large displaced segment of the lingual plate and lower border of the mandible. The involved teeth and the lingual fragment were removed, "with great difficulty," according to the dictum and the generally accepted teachings of British oral surgeons. The anterior teeth were held in occlusion by splints, but the posterior fragment became elevated and union took place in this position, with permanent facial disfigurement. The author states that he would treat this case differently today, and would not remove the bone fragment and the second molar tooth, in order to prevent upward displacement of the posterior fragment.—*Brit. D. J.*, 73:230-232, November 6, 1942.

Comment: This case is indicative of a change toward the more conservative viewpoint of the American oral surgeon with extensive experience in maxillofacial surgery.

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